

Aquatic Surveys and Assessment of the Slim Buttes Region of Harding and Butte Co., SD

Prepared for:

The Montana and South Dakota TNC Field Offices

By:

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Montana Natural Heritage Program
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EXECUTIVE SUMMARY

Project goals of the Aquatic Survey and Assessment of the Slim Buttes Region include: **1)** to sample and assess aquatic community integrity based on macroinvertebrate, fish and habitat sampling, **2)** to identify and interpret key community indicators found at the sites, using standardized protocols and biotic thresholds, and compare these against reference condition standards at the watershed-level and local-reach scale.

Riparian habitat assessments, water quality parameter measurements, and fish and macroinvertebrate surveys were performed at 16 lotic (stream) sites and 2 lentic (ponded) sites within the Slim Buttes Region of the Little Missouri, Upper South Fork Grand and Upper Moreau watersheds. Seventeen of these sites had fish, and all had macroinvertebrates. Two other visited sites were dry. Three longitudinal sequence stream sites were sampled in the Little Missouri and South Moreau rivers; while 2 sequential sites were visited in the North Fork Moreau, South Fork Grand and Jones Creek basins. Biological community integrity was calculated at all sites using Fish Integrated Biotic Indices (IBI's) and Observed/Expected Models (O/E), as well as macroinvertebrate multimetrics (MT MMI). Site summary descriptions based on the overall community integrity and site observations are included.

Habitat Evaluations. Highest site habitat scores using both the EPA RBP (200 max. score) and BLM (24 max. score) habitat assessment methods were measured in the South Fork Grand River basin. South Fork Grand River sites #1 & 2 had reference site conditions for a Great Plains Prairie Stream with EPA RBP scores of 188 and 189, respectively. Most stream sites visited in the Grand River basin had higher than average landscape integrity measured at the local reach scale. Two of the 3 sites in the Little Missouri River basin ranked excellent for a Medium-Large Prairie River. The North Fork Moreau River site #2 had the highest integrity of sites visited in the Moreau River basin. Sites in the South Fork Moreau River scored lowest in habitat integrity. The South Fork Moreau

Site #3 near Hoover showed moderate improvement in habitat integrity from upstream sites, but the water quality parameters showed impairment. The water quality parameters conductivity and turbidity consistently increased at the downstream reaches of a stream series.

Fish Communities. Overall, 22 fish species (16 native/6 introduced or exotic) from 6,227 individuals were reported from all visited sites. Average fish species richness per site was 8, and the most diverse sites were the 3 reaches of the Little Missouri River, with 14 species (11 natives). Fathead minnows were collected at 16 of 17 (94%) fish presence sites. The next highest frequency of occurrence (FO) is the introduced green sunfish at 10 of 17 sites, and the sand shiner and black bullhead at 9 of 17 sites. Using Montana's Prairie Fish IBI, 6 of the 17 fish sites were ranked non-impaired (good to excellent biological integrity), 6 were slightly impaired (moderate integrity) and 5 were moderately impaired (poor biotic integrity). No sites were ranked severely impaired by the Fish IBI. The O/E scores agreed with the IBI scores in most cases, except for the smaller Prairie Intermittent Streams; the O/E ranked Campbell, North Fork Moreau #1 and Crooked Creek as unimpaired (O/E=83.3), while the IBI ranked them as slightly to moderately impaired (IBI=62, 52 and 49, respectively).

Macroinvertebrate Communities. Overall, 118 macroinvertebrate taxa were reported from the Slim Butte 2006 assessment sites. Average macroinvertebrate taxa richness per site was 29 and the highest taxa richness reported at 2 sites was 50 taxa. Using the Montana DEQ macroinvertebrate multimetric index (MMI), 9 of the 18 sites were ranked non-impaired (good to excellent biological integrity), 6 were slightly impaired and 3 were moderately impaired. South Fork Grand River sites #1 & #2 had reference condition macroinvertebrate scores for a Great Plains Prairie Stream with DEQ MMI scores of 75.7 and 69.8, respectively. Most stream sites that contained riffle areas scored much higher with the MMI than sites with exclusively pool areas. Sites

visited in the South Fork Grand River basin received higher macroinvertebrate scores than those in the Moreau basin. The 3 sites in the Little Missouri River basin that ranked high for fish as a Medium-Large Prairie River also received excellent macroinvertebrate integrity scores.

Dragonflies and Damselflies. Incidental dragonfly and damselfly observations were made and recorded during the fish and macroinvertebrate surveys. Three dragonfly species were common across most sites (Common Green Darner, *Anax junius*; Eight-spotted Skimmer *Libellula forensis* and the Variegated Meadowhawk, *Sympetrum corruptum*) and no species of concern were noted at any sites. The pale snaketail, *Ophiogomphus severus*, was only spotted at Medium Prairie River sites with good flow and gravel substrates. The damselflies (Familiar Bluet, *Enallagma civile*, Northern Bluet, *Enallagma cyathigerum*; Eastern Forktail, *Ischnura verticalis* and the Common Spreadwing, *Lestes disjunctus*) were common among the sites. Sites with abundant aquatic vegetation (South Fork Moreau #1, North Fork Moreau #1, Crooked Creek, Campbell Creek and Jones Creek #1 & 2) had abundant populations of larval damselflies as well.

Amphibian and Reptile Incidentals. Incidental herpetofauna observations were made and recorded in conjunction with the fish and macroinvertebrate surveys. Three amphibian species (Woodhouse's Toad, *Bufo woodhousii*, Great Plains Toad, *Bufo cognatus* and the Northern Leopard Frog, *Rana pipiens*) and 2 reptile species (Snapping Turtle, *Chelydra serpentina* and Plains Garter Snake, *Thamnophis radix*) were recorded during the surveys.

Northern Leopard Frogs had the highest site occupancy rate at 72%.

Integrative Community Assessment. Overall, diverse fish and macroinvertebrate communities with high biological integrity are highly correlated with good riparian condition and high habitat quality as ranked by the EPA Habitat Quality Index. Community results from the habitat, fish and macroinvertebrate surveys combined to rank the following sites from highest biological integrity to lowest within their aquatic ecological classification codes:

Medium Prairie River (AES B005): 1) Little Missouri Montana site, 2) Little Missouri #2, 3) Little Missouri@ Camp Crook, 4) South Fork Moreau #3

Northwestern Great Plains Prairie Stream (AES C005): 1) South Fork Grand #2, 2) South Fork Grand #1, 3) North Fork Moreau River #2, 4) Jones Creek #2, 5) Crooked Creek, 6) South Fork Moreau River #2, 7) Bull Creek

Intermittent Prairie Stream (AES code D005): 1) North Fork Moreau #1, 2) South Fork Moreau #1; 3) Campbell Creek, 4) Spur Creek, 5) Hay Creek, 6) Jones Creek #1

Intermittent Fishless Prairie Stream (AES code E005): 1) Pine Spring Creek

Northwestern Great Plains Perennial Spring (AES code S005): 1) Picnic Spring

Jones Creek site #2, near the confluence with the South Fork Grand River, has high ecological potential to recover if hydrologic restoration occurs.

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TABLE OF CONTENTS

Introduction	1
Methods	4
Habitat Assessments	5
Fish Communities	5
Macroinvertebrate Communities	6
Results	9
Habitat Assessment	9
Fish Communities	11
Macroinvertebrate Communities	13
Site Description Summaries	15
Conclusions	57
Literature Cited	58

- Appendix A. Raw fish data and IBI metric calculations collected from Slim Buttes Sites.
- Appendix B. Macroinvertebrate taxa and abundance for the Medium Prairie River (B005) sites
- Appendix C. Significant indicator species of the macroinvertebrate community groups reported for the Slim Buttes Sites.
- Appendix D. Macroinvertebrate community descriptions (SPA-species assemblage).
- Appendix E. Fish community descriptions (SPA-species assemblage).

LIST OF FIGURES

Figure 1. Picnic Spring in the Cave Hills, a small Northwestern Great Plains Perennial Spring	1
Figure 2. The Little Missouri River at the North Dakota border, a Large Prairie River	1
Figure 3. Untilled landscapes in North America's Great Plains ecoregions	2
Figure 4. Study Site Locations and Level IV Ecoregions within the NGPS Slim Buttes Study Area, SD	3
Figure 5. Channel depth measurement as part of the habitat and geomorphic assessments	5
Figure 6. Fish sampling a run by seining with a 20 ft straight seine	5
Figure 7. A western silvery minnow seined in the Little Missouri River before release	5
Figure 8. Multi-habitat macroinvertebrate sampling using EPA protocols	6
Figure 9. Dragonfly observations were made in the stream reach. This is an eight-spotted skimmer (<i>Libellula forensis</i>)	8
Figure 10. The Little Missouri River site near Albion, MT	16
Figure 11. Little Missouri River (AES B005) Medium Prairie River habitat near Albion, MT	16
Figure 12. Little Missouri River (AES B005) cobble/woody debris near Albion, MT	16
Figure 13. Little Missouri River Site #2 (AES B005) run/pool habitat near Ladner, SD	18
Figure 14. Little Missouri River Site #2 (AES B005) sauger (<i>Sander canadensis</i>) an SOC in MT but not SD	18
Figure 15. Little Missouri River Site #2 (AES B005) goldeyes (<i>Hiodon alosoides</i>) a sensitive indicator Medium-Large Prairie River fish species	18
Figure 16. Little Missouri River Site #1 (AES B005) run/pool habitat near Camp Crook, SD	20
Figure 17. Little Missouri River Site #1 (AES B005) run/pool habitat looking upstream	20
Figure 18. Little Missouri River Site #1 (AES B005) cottonwood stand on upper terrace	20
Figure 19. South Fork Moreau River #3 (AES B005) pool habitat, looking downstream near Hoover, SD	22

LIST OF FIGURES (CONTINUED)

Figure 20. South Fork Moreau River #3 (AES B005) run/pool habitat, looking upstream near Hoover, SD	22
Figure 21. South Fork Moreau River #3 (AES B005) exposed layer of dense fossils in right bank	22
Figure 22. South Fork Moreau River #3 (AES B005) petrified tree stumps on right bank	22
Figure 23. South Fork Grand River #2 (AES C005) with reference condition landscape and local-reach overview from bridge	25
Figure 24. South Fork Grand River #2 (AES C005) bottom of reach looking upstream	25
Figure 25. South Fork Grand River #2 (AES C005) bottom of reach looking downstream	25
Figure 26. South Fork Grand River #1 (AES C005) looking downstream towards county bridge	27
Figure 27. South Fork Grand River #1 (AES C005) bottom riffle of reach looking upstream	27
Figure 28. South Fork Grand River #1 (AES C005) top 150m long pool	27
Figure 29. South Fork Grand River #1 (AES C005) catfish seined in the top pool	27
Figure 30. North Fork Moreau River (AES C005) Marty Bridge site not sampled	29
Figure 31. North Fork Moreau River #2 (AES C005) upper riffle looking downstream	29
Figure 32. North Fork Moreau River #2 (AES C005) bottom of reach looking upstream	29
Figure 33. Jones Creek #2 (AES C005) pool upstream from road crossing	32
Figure 34. Jones Creek #2 (AES C005) pools below the road crossing	32
Figure 35. Jones Creek #2 (AES C005) typical green sunfish, an introduced species	32
Figure 36. Jones Creek #2 (AES C005) riffle downstream from road crossing	32
Figure 37. Crooked Creek (AES C005) looking upstream near Cox Church	35
Figure 38. South Fork Moreau River #2 (AES C005) pool habitat, looking upstream near Rte. 85 bridge	37
Figure 39. South Fork Moreau River #2 (AES C005) pool habitat, top of reach	37
Figure 40. South Fork Moreau River #2 (AES C005) pool habitat, cottonwood trees top of reach	37
Figure 41. Bull Creek (AES C005) a silt-impaired Great Plains stream near Brown Rd.	39
Figure 42. North Fork Moreau River #1 (AES D005) pool #3 looking upstream	42
Figure 43. North Fork Moreau River #1 (AES D005) pool #2 looking upstream	42
Figure 44. South Fork Moreau River #1 (AES D005) vegetative pool habitat, looking from bridge	44
Figure 45. South Fork Moreau River #1 (AES D005) beaver dam pool habitat	44
Figure 46. South Fork Moreau River #1 (AES D005) pool habitat looking up	44
Figure 47. Campbell Creek (AES D005) pool looking downstream towards Brown's Pond	47
Figure 48. Campbell Creek (AES D005) pool looking upstream towards inlet	47
Figure 49. Spur Creek (AES D005) a tributary to SF Moreau River looking upstream	49
Figure 50. Spur Creek (AES D005) a backed up section behind a culvert	49
Figure 51. Hay Creek (AES D005) a tributary to SF Moreau River looking upstream	51
Figure 52. Hay Creek (AES D005) aquatic water-plantain (<i>Alisma triviale</i>)	51
Figure 53. Jones Creek #1 (AES D005) small remaining pool in reach	53
Figure 54. Jones Creek #1 (AES D005) dead snapping turtle found on side of Rte. 85 bridge	53
Figure 55. Pine Spring Creek (AES E005) a Great Plains Fishless Intermittent Stream with moderate landscape integrity and degraded local conditions	55

LIST OF TABLES

Table 1. Site descriptions for study sites included in the TNC Slim Buttes surveys	4
Table 2. Fish metrics and classification of fish species captured in the Slim Buttes Region (2006)	7
Table 3. Impairment determinations from the MMI and O/E (RIVPACS) models	8

LIST OF TABLES (CONTINUED)

Table 4.	Physical measures, WQ parameters and habitat descriptions for the Slim Butte (SD) study sites	9
Table 5.	Aquatic Ecological System types, occurrences in the database and the biological community groups associated with the defined aquatic ecological communities	10
Table 6.	Fish Species Presence, Frequency of Occurrence (FO) all study sites, and for particular Aquatic Ecological Systems (AES) included in the TNC Slim Buttes surveys	11
Table 7.	Fish and macroinvertebrate species, MT IBI, MT MMI and Observed/Expected (O/E) scores for the Slim Butte (SD) study sites	12
Table 8.	Herpetofauna, Aquatic Plant and Dragonfly/Damselfly Species Observations for sites of the Slim Buttes Watershed Assessment	14

INTRODUCTION

Prairie stream systems throughout North America have suffered neglect due to a lack of comprehensive study and understanding (Matthews and Robison 1988, Dodds et al. 2004). Only recently have there been efforts to sample and describe the interactions among the state's prairie stream aquatic biota, and to relate prairie system aquatic communities to their landscapes. This study covers one such undocumented area, South Dakota's Slim Buttes region. From the smallest prairie spring (Figure 1) to the Little Missouri River as it leaves South Dakota a large prairie river (Figure 2), the Slim Buttes region contains a wide variety of aquatic ecosystems.



Figure 1. Picnic Spring in the Cave Hills, a small Northwestern Great Plains perennial spring.



Figure 2. The Little Missouri River at the North Dakota border, a large prairie river.

As a whole, the Slim Buttes area is an important part of a large swath of untilled prairie area in the Level III Northwestern Great Plains ecoregion (Omerink 1995) (Figure 3), also known as the Northern Great Plains Steppe (TNC 1999). Four Level IV ecoregions are found within the Slim Buttes area (Figure 4). Because intact watershed landscapes at the regional scale have been shown to support aquatic communities with high biological integrity (Allan et al. 1997), we surmised that the Slim Buttes region might support some of the most intact native prairie fish and macroinvertebrate communities in the state. One fairly recent study in the Moreau River Basin downstream from our study area reported 19 species of fish (16 native) (Loomis 1997).

To determine if this were true, we used an aquatic ecosystem classification approach developed by the Montana Natural Heritage Program (MTNHP) to increase the understanding of Montana's aquatic prairie ecosystems (Stagliano 2005). Ecosystem classification provides a way to understand the complexity of ecosystems and creates distinctions among ecosystem types based on factors that determine the distribution of ecological processes and biota (Hawkins and Norris 2000). We previously classified biological communities (fish and macroinvertebrates) within the Missouri River Zoogeographic Region with respect to the common repeatable habitat units within the watersheds that they occur. The Slim Buttes area is within the same Level III ecoregion, so we hoped that utilizing these classifications would validate their regional applicability while allowing us to predict community types in the scope of watersheds and aquatic ecological units.

Untilled Landscapes in the Ecoregions of the Great Plains

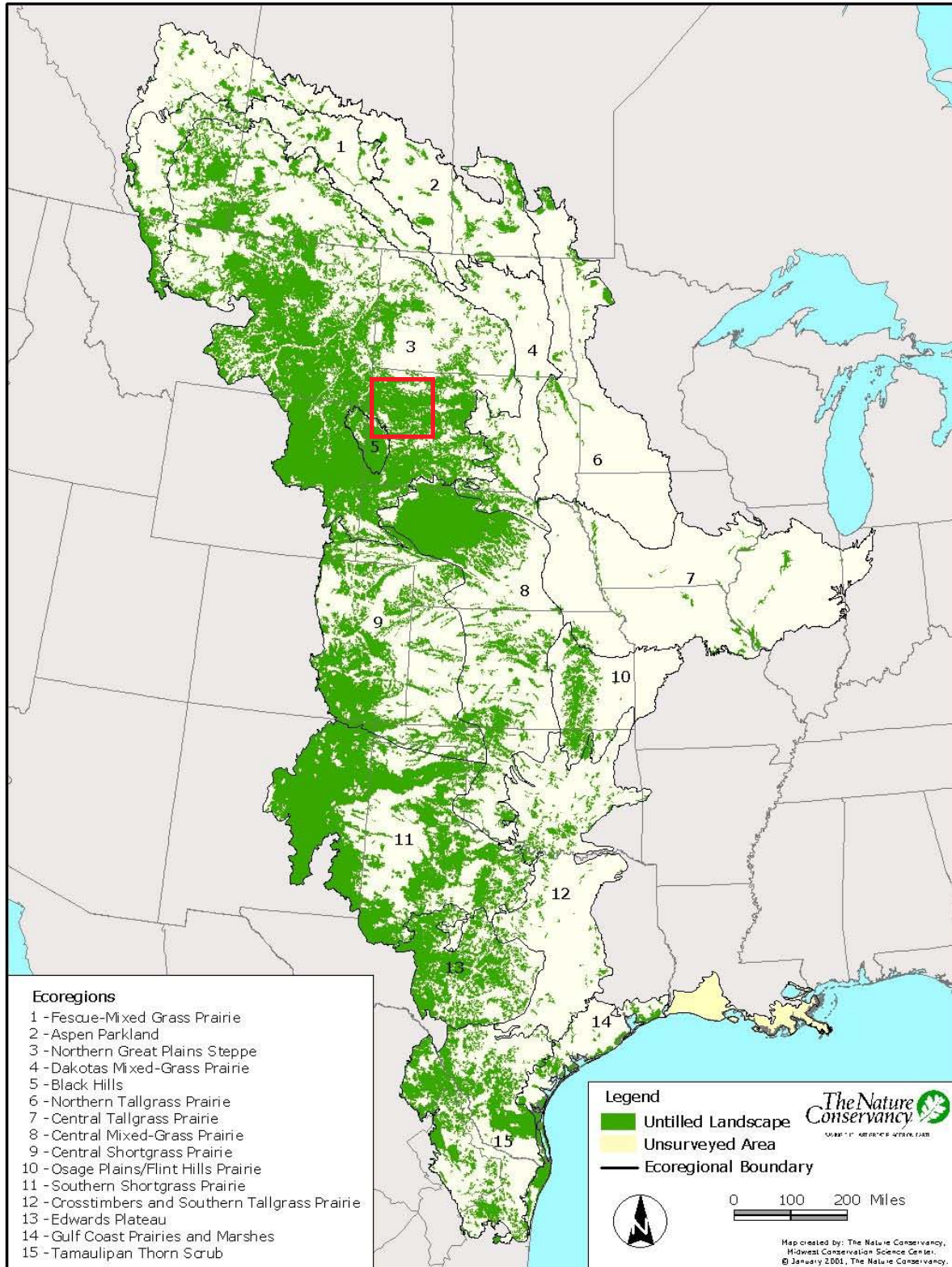


Figure 3. Untilled landscapes in North America's Great Plains ecoregions.

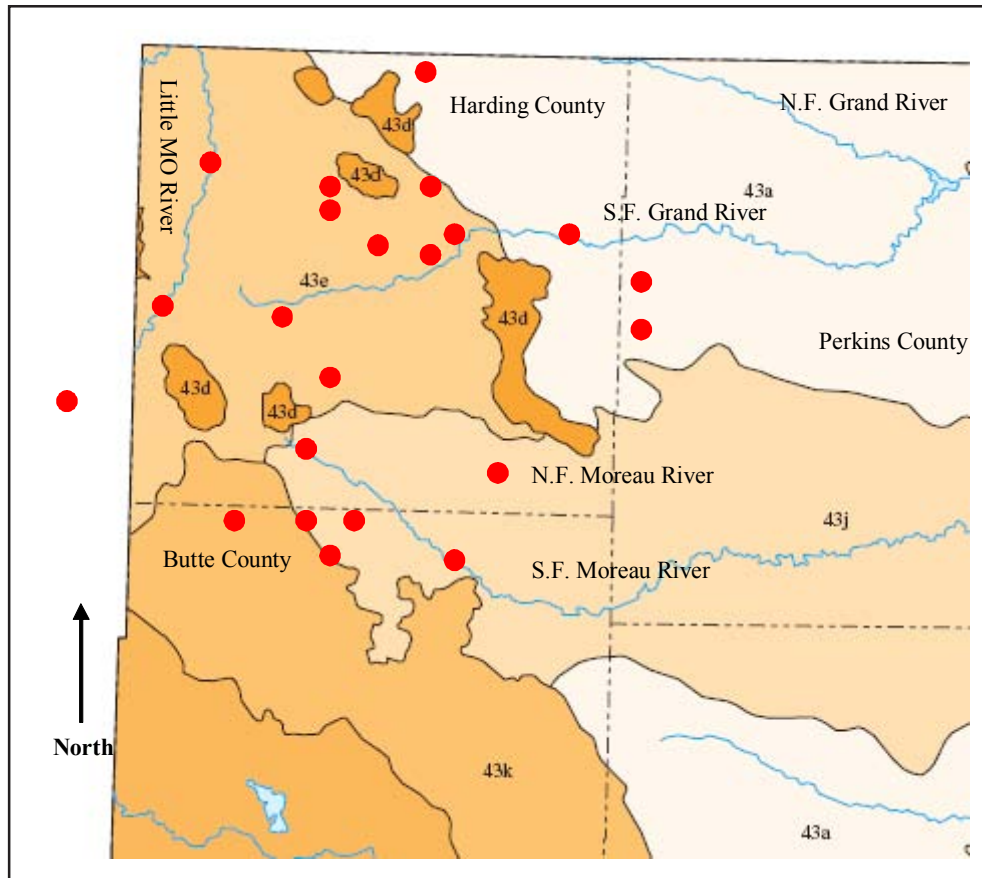


Figure 4. Study Site Locations and Level IV Ecoregions within the NGPS Slim Buttes Study Area, SD. 43a=Missouri Plateau, 43d=Forested Buttes, 43e=Sagebrush Steppe, 43j=Moreau Prairie

METHODS

Riparian habitat assessments, water quality parameters, fish and macroinvertebrate surveys were performed at 16 lotic (stream) sites and 2 lentic (ponded) sites within the Slim Buttes Region of the Little Missouri, Upper South Fork Grand and Upper Moreau watersheds (Table 1). Seventeen of these sites had fish, and all had macroinvertebrates.

Two other visited sites were dry. Three longitudinal sequence stream sites were sampled in the Little Missouri and South Moreau Rivers, while 2 sequential sites were visited in the North Fork Moreau, South Fork Grand River and Jones Creek basins (Site #1 of any sequence is the furthest upstream site).

Table 1. Site descriptions for study sites included in the TNC Slim Buttes surveys. AES=Aquatic Ecological System, HUC=8-digit USGS Hydrologic Unit Code, SSO=Strahler Stream Order

Site	AES Code	Date Visited	County	HUC	GPS Lat*	GPS Long*	Elevation (ft)	SSO
Crooked Creek	C005	6/6/2006	Harding	10020006	45.9067	103.5030	3018	3
Little MO MT	B005	6/5/2006	Carter	10110201	45.2757	103.6475	3140	4
Little MO #1	B005	6/5/2006	Harding	10110201	45.5642	103.9531	3124	4
Little MO #2	B005	6/5/2006	Harding	10110201	45.7757	103.8865	3024	4
Pine Spring Cr	E005	6/5/2006	Harding	10130302	45.5469	103.7800	3064	2
S F Grand #1	C005	6/7/2006	Harding	10130302	45.6389	103.3128	2721	4
Jones Cr #2	C005	6/7/2006	Harding	10130302	45.6390	103.3232	2730	3
S F Grand #2	C005	6/6/2006	Harding	10130302	45.6395	102.9990	2581	4
Jones Cr #1	D005	6/6/2006	Harding	10130302	45.6877	103.4885	3005	1
Bull Creek	D005	6/5/2006	Harding	10130302	45.7841	103.5007	2885	3
Campbell Cr	D005	6/5/2006	Harding	10130302	45.8092	103.4997	2934	2
S F Moreau #3	B005	6/7/2006	Butte	10130304	45.1168	103.2709	2750	4
S F Moreau #2	C005	6/6/2006	Butte	10130304	45.1261	103.5497	2919	3
S F Moreau #1	D005	6/6/2006	Butte	10130304	45.1785	103.6508	2968	2
Spur Creek	D005	6/6/2006	Butte	10130304	45.1885	103.6354	2997	2
Hay Creek	D005	6/6/2006	Butte	10130304	45.1983	103.6238	2995	2
N F Moreau #2	C005	6/7/2005	Harding	10130305	45.2697	103.1979	2821	2
Antelope Creek (old sample site)	D005	7/8/2000	Perkins	10130305	45.3132	102.6876	2822	2
Antelope Creek (dry)	D005	6/7/2005	Perkins	10130305	45.3272	102.9204	2845	1
N F Moreau #1	D005	6/6/2006	Harding	10130305	45.3575	103.5479	3071	2
Rabbit Creek (dry)	D005	6/7/2005	Perkins	10130305	45.4436	102.9110	2795	2

* GPS readings were taken from the top and bottom of reach, only top GPS reading is reported here.

Habitat Evaluations

On-site habitat assessments were conducted using the rapid assessment protocol (RBP Level 1, scores 0-200) developed for the EPA by Barbour et al. (1999) with modifications and additions by the National Aquatic Assessment of the Bureau of Land Management (BLM) Buglab (scores 0-24) (<http://www1.usu.edu/buglab/forms/Bug%20Protocol%20form.pdf>). Using the BLM assessment protocols, the reach was divided into 10 equally spaced transects. Parameters recorded at each were: wetted width, bankfull width, 3 channel depth measurements, large woody debris and riparian shading. Basic water chemistry parameters (temperature, pH, conductivity, dissolved O₂ and turbidity) were recorded prior to sampling using the Horiba H-10. The goal of these evaluations is to characterize local reach geomorphology, riparian and in-stream habitat, and other characteristics that influence aquatic community integrity (Figure 5). The sites ranking higher using these protocols are determined to have higher quality local-scale habitat. Habitat assessments were performed during the same visit as the biological sampling.



Figure 5. Channel depth measurement as part of the habitat and geomorphic assessments.

Fish Communities

Fish sampling protocols (MTFWP 2003) required the positioning of upstream and downstream block nets at the ends of the reach (300m or 40x wetted width), but most of the time shallow sections and/or riffle areas were sufficient to prevent fish from

escaping while the run & pool areas were being seined from the upstream to the downstream direction with a 20-30 ft $\frac{1}{4}$ inch straight seine, depending on wetted width (Figure 6). Fish were transferred to holding buckets, identified to species, enumerated in the field, examined for external anomalies (e.g. deformities, eroded fins, lesions, and tumors), and then released (Figure 7). Young-of-the-year fish less than 20 millimeters in length were noted on the field sheet (not included in the totals), and released. Voucher specimens were only taken in the case of uncertain field identifications of the silvery minnows, *Hybognathus* spp., which were preserved in 10% buffered formalin and identified in the lab. Vouchers were submitted to the Montana State University fish collection.



Figure 6. Fish sampling a run by seining with a 20 ft straight seine.



Figure 7. A western silvery minnow seined in the Little Missouri River before release.

Analysis of the sampled fish communities used Integrated Biotic Indices (IBI) (Bramblett et al. 2005) and derived Observed/Expected (O/E) Fish Models (Stagliano 2005) to detect impairment in the biological integrity of the sites. The IBI involved calculation of a series of metrics evaluating different attributes of the community (Table 2). The metrics allowed calculation of an overall score between 0 and 100. Bramblett et al. (2005) did not propose threshold criteria for good, fair, and poor biological integrity for these scores. Therefore, we applied commonly used criteria. Scores of 75 to 100 indicate good to excellent biological integrity, 50-74 fair to good biological integrity, 25 to 49 indicated poor to fair biological integrity and scores <25% indicate poor biological integrity or severely impaired.

Macroinvertebrate Communities

Macroinvertebrates were collected from all habitats that we could wade within the sampling reach of the streams (Figure 8). Sampling involved multi-habitat, qualitative methods outlined in the EPA protocols (Barbour et al. 1999). Cobble substrates, vegetation, woody debris and bank-side areas were sampled qualitatively with a 500-micron D-frame net within the designated transects. A total of twenty habitat-weighted, randomized 0.5m jabs or kicks were conducted within the reach, allowing 10 seconds per kick and composited into one sample. All organisms in the net were washed on a 500-micron sieve, transferred to a 1 liter Nalgene bottle, labeled and preserved in 95%



Figure 8. Multi-habitat macroinvertebrate sampling using EPA protocols.

ethanol and brought to the MTNHP lab in Helena for processing.

These samples were processed (sorting, identification, and data analysis) by David Stagliano at the Helena lab following DEQ protocols (MT DEQ 2005). Macroinvertebrates were identified to the lowest taxonomic level, imported into EDAS (Jessup 2006), and biological metrics were calculated from the data using the Montana Department of Environmental Quality's newest multimetric macroinvertebrate (MMI) protocols (Jessup et al. 2005, Feldman 2006). Metric results were then scored using the Montana DEQ bioassessment criteria and each sample categorized as non-impaired or impaired according to threshold values (Table 3).

The macroinvertebrate MMI score is based upon a series of metrics that measure attributes of benthic macroinvertebrate communities regarding condition changes to a stream system (in the form of pollution or pollutants). The invertebrate metrics include: **EPT Taxa Richness (Score = $\text{EPT richness}/14 \times 100$)**: Ephemeroptera, Plecoptera & Trichoptera taxa; **Percent Tanypodinae (Score = $\text{Percent Tanypodinae}/10 \times 100$)**; **Percent Orthocladiinae of Chironomidae (Score = $(100 - \text{percent Orthocladiinae of Chironomidae}) \times 100$)**; **Predator Taxa Richness (Score = $\text{number of predator taxa}/9 \times 100$)**; **Percent Collectors and Filterers (Score = $(100 - \text{percent collectors and filterers})/65 \times 100$)**: This metric measures the relative abundance of collector and filterer taxa in the sample. The index score represents the condition of the macroinvertebrate community at the time the sample was collected within that past year. If the index score is below the impairment threshold, the individual metrics can be used to provide insight as to why the communities are different from the reference condition (Barbour et al. 1999, Jessup et al. 2005). The impairment threshold set by MT DEQ is **37** for the Eastern Plains Stream Index; thus any scores above this threshold are considered unimpaired. South Dakota does not yet have macroinvertebrate models to calculate scores. For the Observed/Expected (O/E) scores, taxa in the sample were compared to their expected macroinvertebrate indicator species for that classified prairie aquatic ecological type (Stagliano 2005) (Appendix C).

Table 2. Fish metrics and classification of fish species captured in the Slim Buttes Region (2006).

Species	Scientific Name	Trophic*	Feeding Mode†	Litho-obligate Reprod Guild‡	Tol**	Origin ††	Total Length 3 years
Hiodontidae							
Goldeye	<i>Hiodon alosoides</i>	IN	WC	LO	INT	N	259
Catostomidae							
River carpsucker	<i>Carpionodes carpio</i>	OM	BE	LO	MOD	N	229
Shorthead Redhorse	<i>Moxostoma macrolepidotum</i>	IN	BE	LO	MOD	N	254
White sucker	<i>Catostomus commersoni</i>	OM	BE	LO	TOL	N	229
Cyprinidae							
Common carp	<i>Cyprinus carpio</i>	OM	BE		TOL	I	381
Golden shiner	<i>Notemigonus crysoleucas</i>	OM	WC		MOD	I	102
Flathead Chub	<i>Platygobio gracilis</i>	IN	GE		MOD	N	140
Fathead Minnow	<i>Pimephales promelas</i>	OM	GE		TOL	N	76
Longnose dace	<i>Rhinichthys cataractae</i>	IN	BE	LO	INT	N	71
Brassy minnow	<i>Hybognathus hankinsoni</i>	HB	BE		MOD	N	94
Plains minnow	<i>Hybognathus placitus</i>	HB	BE		MOD	N	94
Western silvery minnow	<i>Hybognathus argyritus</i>	HB	BE		MOD	N	94
Sand shiner	<i>Notropis stramineus</i>	OM	GE	LO	MOD	N	61
Esocidae							
Northern pike	<i>Esox lucius</i>	CA	WC		MOD	I	457
Gasterosteidae							
Brook stickleback	<i>Culaea inconstans</i>	IN	GE	TR§	MOD	N	64
Centrarchidae							
Green sunfish	<i>Lepomis cyanellus</i>	IC	GE		TOL	I	102
Percidae							
Iowa darter	<i>Etheostoma exile</i>	IN	BE		INT	N	51
Sauger	<i>Sander canadensis</i>	IC	GE	LO	MOD	N	279
Ictaluridae							
Channel catfish	<i>Ictalurus punctatus</i>	IC	BE	TR§	MOD	N	254
Stonecat	<i>Noturus flavus</i>	IC	BE	LO	INT	N	140
Black bullhead	<i>Ameiurus melas</i>	IC	BE	TR§	TOL	I	152
Yellow bullhead	<i>Ameiurus natalis</i>	IC	BE	TR§	MOD	I	254

*HB = herbivore (> 90% plants or detritus); IC = invertivore/carnivore (>25% both invertebrates and vertebrates); IN = invertivore; OM = omnivore(25-90% plants or detritus) CA=carnivore (90% fish or other vertebrates);

† BE = benthic; GE = generalist; WC = water column: Brown (1971); Scott and Crossman (1973); Becker (1983)

‡ LO=Litho-obligate Reproductive Guild; Scott and Crossman (1973); Pflieger (1997); Barbour et al. (1999)

§ Tolerant reproductive strategists are not litho-obligates, use parental care at spawning site: Scott and Crossman (1973); Pflieger (1997)

** INT = intolerant; MOD = moderately tolerant; TOL = tolerant; Barbour et al. (1999);

†† N = native; I = introduced; Holton and Johnson (2003), SD Fish Species List (SD Heritage Program)

Table 3. Impairment determinations from the MMI and O/E (RIVPACS) models (taken from Jessup et al. 2005, Feldman 2006).

Ecoregion	RIVPACS	MMI	Impairment Determination
Mountain	≥ 0.8 or ≤ 1.2	≥ 63	Not impaired
	< 0.8 or > 1.2	< 63	Impaired
Low Valley	≥ 0.8 or ≤ 1.2	≥ 48	Not impaired
	< 0.8 or > 1.2	< 48	Impaired
Eastern Plains	≥ 0.8 or ≤ 1.2	≥ 37	Not impaired
	< 0.8 or > 1.2	< 37	Impaired

Dragonflies and Damselflies

Incidental dragonfly and damselfly observations were made and recorded during the fish and macroinvertebrate surveys. The dragonfly identifications and observations were usually done on the wing, but we did collect numerous damselflies and an occasional reference dragonfly using an aerial sweep net along the riparian vegetation (Figure 9).



Figure 9. Dragonfly observations were made in the stream reach. This is an eight-spotted skimmer (*Libellula forensis*).

RESULTS

The Slim Buttes region of northwest South Dakota is an excellent example of untilled, intact Northwestern Great Plains or Northern Great Plains Steppe. The extent of some of these intact prairies and quality of the landscape rivals or exceeds landscapes that I have personally seen in Northwestern Great Plains reference sites of southeast Montana. One of the most impressive areas includes the landscape of the South Fork of the Grand River watershed, which exhibited high integrity at the landscape level and at the local stream-reach scale. We identified fish and macroinvertebrate communities with high ecological integrity within 5 Prairie Aquatic Ecological Systems (AES) during this study: Medium Prairie River (AES B005), Northwestern Great Plains Prairie (AES C005) and Intermittent Prairie Streams (AES code D005), Intermittent Fishless Prairie Stream (AES code E005) and the Northwestern Great Plains Perennial Spring (AES code S005) (Table 4).

Habitat Evaluations

Overall, 11 of 18 sites had good to excellent habitat quality ranked by at least one of the assessment

methods (Table 5). Highest site habitat scores using both the EPA RBP (200 max. score) and BLM (24 max. score) habitat assessment methods were measured in the South Fork Grand River basin. South Fork Grand River Sites #1 & #2 had reference site conditions for a Great Plains Prairie Stream with EPA RBP scores of 188 and 189, respectively (Table 5). Most stream sites visited in the Grand River basin had higher than average landscape integrity measured at the local reach-scale. All sites in the Little Missouri River basin ranked high for a Medium-Large Prairie River. The North Fork Moreau River site #2 had the highest integrity of sites visited in the Moreau basin. Sites in the South Fork Moreau River scored lowest in habitat integrity. South Fork Moreau site #3 near Hoover showed moderate integrity but the water quality parameters show impairment. The water quality parameters conductivity and turbidity both increased at the downstream reaches of a stream series. Two conductivity values that would exceed DEQ impairment standards in Montana were recorded at the South Fork Moreau River #3 and the Crooked Creek sites (>3,000 μ S).

Table 4. Aquatic Ecological System types, biological community groups (SPA) associated with the defined aquatic ecological communities and occurrences in the Slim Buttes Study Area.

Aquatic Ecological System	AES code	Fish SPA[^]	Macroinvert groups*	Number of Occurrence**
Medium Prairie River Ecosystem	B005	1, 2, 18, 20	3, 9, 11, 37, 40	4
Great Plains Prairie Stream Ecosystem	C005	2, 20	9, 11, 12, 37	6
Great Plains Intermittent Stream Ecosystem	D005	18, 20	9, 12	9
Great Plains Fishless Intermittent Stream Ecosystem	E005	None	12	1
Small Fishless Prairie Spring Ecosystem	S005	None	1, 12	1

[^]See Appendix E for Fish Species Assemblages

* See Appendix C & D for Macroinvertebrate species groups

**Number of sites visited with data collected

Table 5. Physical measures, WQ parameters and habitat descriptions for the Slim Butte (SD) study sites. LUI=Livestock Use Index, %RP_S= % Riparian Shading, % LWD=transects out of 10 w/ Large Woody Debris present, Cond=Conductivity (µS/cm), DO=dissolved oxygen (mg/L), Turb=Turbidity (NTUs). Bold-underlined are excellent reach scores, shaded grey represent good local-reach conditions.

	Avg stream width (m)	Avg channel depth (cm)	Reach Length (m)	EPA Habitat Quality Index (RBP)	BIM Site Evaluation	LUI	% RP_S	% LWD	% cobble	% fines in reach	pH	Cond	DO	Turb	Water Temp (C)
Moreau River Basin															
N F Moreau #1	1.9	45.9	300	160	17	20	0	0	0.0	75.0	8.5	633	4.3	40	17.6
N F Moreau #2	4.4	34.3	300	178	23	0	0	0	12.0	12.0	9.1	2060	9	62	24
S F Moreau #1	4.1	48.5	180	139	16	20	10	30	0.0	100.0	8.6	1030	7	18	18.2
S F Moreau #2	4.9	64.0	300	97	12	5	30	30	0.0	100.0	8.6	1130	6	50	26.2
S F Moreau #3	6.8	46.6	300	128	15	8	20	10	15.0	25.0	8.9	3380	3.5	68	26.1
Spur Creek	4.5	25.1	100	150	18	12	0	0	0.0	75.0	8.5	1190	5	24	25.5
Hay Creek	5.6	33.1	100	129	16	15	0	0	0.0	100.0	8.5	1260	4	128	25.8
Grand River Basin															
Jones Cr #1	1.8	18.0	50	125	16	25	0	0	0.0	100.0	8.6	2150	3.5	22	22.1
Jones Cr #2	3.4	35.0	100	175	20	10	0	0	5.0	25.0	8.8	2380	4	58	21.9
S F Grand #1	7.0	25.0	300	188	23	6	0	0	53.0	10.0	8.3	1830	8.3	40	19.3
S F Grand #2	8.2	24.0	300	189	23	8	0	10	16.0	25.0	8.3	2120	8.3	56	27.1
Campbell Creek	4.5	25.0	100	148	17	10	0	10	0.0	90.0	8.5	1200	9	10	22.6
Bull Cr #1	3.8	25.0	100	128	16	5	0	0	0.0	100.0	8.7	1950	7	40	23.8
Crooked Cr #1	4.2	55.0	100	152	17	0	0	0	0.0	75.0	9.2	3010	6.5	14	19.3
Pine Spring Creek	2.1	14.9	100	126	16	45	0	10	0.0	75.0	8.5	890	8	58	19.5
Little Missouri Basin															
Little MO #2	15.4	38.5	300	180	22	20	10	20	7.0	16.0	8.5	1080	8	84	19.1
Little MO #1 Camp Crook	11.8	50.7	300	172	19	0	0	30	17.5	8.0	8.6	1040	8	52	21.9
Little MO MT	9.8	35.5	300	188	23	7	10	30	10.0	10.0	8.5	1010	10	72	18.8

Fish Communities

Overall, 22 fish species (16 native/6 introduced or exotic) from 6,227 individuals were reported from all visited sites (Table 2, Appendix A). Average fish species richness per site was 8, and the most diverse sites were the 3 reaches of the Little Missouri River, with 14 species (11 natives). Fathead minnows were collected at 16 of 17 (94%) fish presence sites. The next highest frequency of occurrence (FO) is the introduced green sunfish at 10 of 17 sites, and the sand shiner and black bullhead at 9 of 17 sites. Flathead chubs and plains minnows round out the top 6 fish species collected across all fish sites (Table 6). Fish species highly associated (100% of the time) with the Medium Prairie River Ecological System (AES B005) included sand shiner, flathead chub, plains minnow, channel catfish, white sucker, river carpsucker, stonecat and western silvery minnow (Table 6).

In the Great Plains Intermittent Prairie Streams, the species occurring most often were the brook stickleback, brassy minnow and fathead minnow (Table 6). Using Montana's Prairie Fish IBI, 6 of the 17 fish sites were ranked non-impaired (good to excellent biological integrity), 6 were slightly impaired (moderate integrity) and 5 moderately impaired (poor biotic integrity) (Table 7). No sites were ranked severely impaired by the Fish IBI. The O/E scores agreed with the IBI scores in most cases, except for the smaller Prairie Intermittent Streams; the O/E ranked Campbell, North Fork Moreau #1 and Crooked Creek as unimpaired (O/E=83.3), while the IBI ranked them as slightly to moderately impaired (IBI=62, 52 and 49, respectively).

Fish community structure in the Slim Buttes sites responded to two primary landscape factors: the

Table 6. Fish Species Presence, Frequency of Occurrence (FO) at all study sites, and for particular Aquatic Ecological Systems (AES) included in the TNC Slim Buttes surveys.

Blanks indicate absence from that stream type.

Fish Species	# of Sites Present	Overall FO	AES B005 FO	AES C005 FO	AES D005 FO
Fathead Minnow	16	0.94	0.75	1.00	1.00
Black Bullhead	10	0.59	0.50	1.00	0.29
Green Sunfish	10	0.59	0.75	1.00	0.14
Sand Shiner	9	0.53	1.00	0.83	
Flathead Chub	8	0.47	1.00	0.67	
Plains Minnow	8	0.47	1.00	0.67	
Channel Catfish	7	0.41	1.00	0.50	
Longnose Dace	7	0.41	0.75	0.67	
White Sucker	7	0.41	1.00	0.33	0.14
River Carpsucker	6	0.35	1.00	0.33	
Stonecat	6	0.35	1.00	0.33	
Western Silvery Minnow	6	0.35	0.75	0.50	
Brook Stickleback	3	0.18		0.17	0.29
Common Carp	3	0.18	0.75		
Goldeye	3	0.18	0.75		
Shorthead Redhorse	3	0.18	0.75		
Yellow Bullhead	2	0.12		0.33	
Golden Shiner	2	0.12		0.17	0.14
Iowa Darter	2	0.12		0.17	0.14
Brassy Minnow	1	0.06			0.14
Northern Pike	1	0.06	0.25		
Sauger	1	0.06	0.25		

stream size/drainage area & discharge (lotic-connected vs. lentic-ponded-unconnected conditions), and the human-factor, stock pond/fish species introductions. Increasing drainage area directly relates to increasing fish diversity (Angermeier and Schlosser 1989, Bramblett et al. 2005), which is evident in the greater number of expected indicator species in our fish assemblages for the medium and larger prairie river systems. Clearly, measures of connectivity are important in structuring fish communities (Matthews and Robison 1998, Bramblett and Fausch 1991). Many

fish, even warmwater species (e.g. sauger, channel catfish), are migratory during their spawning periods (Holton and Johnson 2003) or pioneering (e.g. white sucker, shorthead redhorse) and will opportunistically search for suitable habitats. If the conditions are favorable for fish species to migrate into a particular type of aquatic system, especially if connectivity is complete across the basin or there is connectivity to reservoirs or other pools of non-native fishes, then the community observed might be surprisingly different than what was expected. This explains white suckers co-occurring with

Table 7. Fish and macroinvertebrate species, IBI's, MT MMI's and Observed/Expected (O/E) scores for the Slim Butte (SD) study sites. Bold-underlined score are good-excellent reach scores, shaded gray represent fair-good local-reach conditions.

	Fish Species Total	Fish Species Native	Fish IBI	O/E	Macro- invert Taxa	MT MMI	O/E
Moreau River Basin							
N F Moreau #1	2	2	51.51	75.00	25	28.00	60.00
N F Moreau #2	11	8	90.26	103.23	34	57.00	>80
S F Moreau #1	7	4	56.65	51.61	28	35.00	65.00
S F Moreau #2	5	3	34.92	38.71	20	22.00	40.00
S F Moreau #3	11	9	71.30	116.13	34	45.60	62.00
Trib to S.F. Moreau (Spur)	1	1	48.08	50.00	24	34.92	60.00
Trib to S.F. Moreau (Hay)	1	1	49.91	50.00	22	28.00	55.00
Grand River Basin							
Jones Cr #1	1	1	44.76	50.00	23	35.60	61.00
Jones Cr #2	8	5	88.29	64.52	28	58.90	>80
S F Grand #1	12	9	99.77	116.13	38	75.70	>80
S F Grand #2	11	9	103.61	116.13	35	69.80	>80
Campbell Creek	2	2	62.05	83.30	30	35.60	>80
Bull Cr #1	2	1	43.60	50.00	19	24.80	50.00
Crooked Cr #1	5	3	51.97	83.30	29	39.50	>80
Pine Spring Creek	no fish	no fish	no fish	no fish	22	32.50	61.00
Little Missouri River Basin							
Little MO #2	14	12	87.63	100.00	36	72.60	>80
Little MO #1 Camp Crook	14	12	65.19	92.10	32	63.37	>80
Little MO MT	14	11	88.05	100.00	50	62.50	>80

fathead minnows and brook sticklebacks, the usual inhabitants, in the upper South Fork Moreau site #1.

The influence of fish stocking is considerable. Green sunfish and black bullhead, two introduced fish species, dominated some sites. We know that most stock ponds and reservoirs in this part of the state have been stocked with various introduced species of fish at some time (Doug Backland, SD NHP, pers. comm. 2006). In addition to reducing native fish numbers through competition, stocked fish can often overwhelm a stream reach and displace the natives. Since the non-native or stocked fish now represent self-sustaining communities, they have considerable influence on the stream ecosystems.

Macroinvertebrate Communities

Overall, 118 macroinvertebrate taxa were reported from the Slim Butte 2006 assessment sites. Average macroinvertebrate taxa richness per site was 29 and the highest taxa richness reported at one site (Little Missouri) was 50 taxa (Appendix B). Using the Montana DEQ macroinvertebrate multimetric index (MMI), 9 of the 18 sites were ranked non-impaired (good to excellent biological integrity), 6 were slightly impaired and 3 moderately impaired (Table 7). South Fork Grand River sites #1 & #2 had reference condition macroinvertebrate scores for a Great Plains Prairie Stream with DEQ MMI scores of 75.7 and 69.8, respectively (Table 7). The Little Missouri River sites ranked excellent with Montana MMI scores in the 60's and lower 70's. Sites visited in the South Fork Grand River basin received higher macroinvertebrate scores than those in the Moreau basin. The 3 sites in the Little Missouri River basin that ranked high for fish as a Medium-Large Prairie River, received excellent macroinvertebrate integrity scores. Macroinvertebrate community structure in the Slim Buttes sites responded to similar landscape factors as found with fish (stream size and lotic-connected vs. lentic-ponded-unconnected conditions), but were less affected by the connectivity of pools. However, most stream sites that contained riffle areas between the pools scored much higher with the MMI than sites with exclusively pool areas. The Montana MMI was

not as effective at ranking intermittent sites that contained intact communities, but were dominated by the more tolerant species of that assemblage.

Dragonflies and Damselflies

Incidental dragonfly and damselfly observations were made and recorded during the fish and macroinvertebrate surveys (Table 8). Three dragonfly species were common across most sites (Common Green Darner, *Anax junius*; Eight-spotted Skimmer, *Libellula forensis* and the Variegated Meadowhawk, *Sympetrum corruptum*) and no species of concern were noted at any sites. The pale snaketail, *Ophiogomphus severus*, was only spotted at Medium Prairie River sites with good flow and gravel substrates. The damselflies (Familiar Bluet *Enallagma civile*, Northern Bluet, *Enallagma cyathigerum*, Eastern Forktail, *Ischnura verticalis* and the Common Spreadwing, *Lestes disjunctus*) were common among the sites. Sites with abundant aquatic vegetation (South Fork Moreau #1, North Fork Moreau #1, Crooked Creek, Campbell Creek and Jones Creek #1 & 2) had abundant populations of larval damselflies as well.

Amphibian and Reptile Incidentals

Incidental herpetofauna observations were made and recorded in conjunction with the fish and macroinvertebrate surveys. Three amphibian species (Woodhouse's Toad, *Bufo woodhousii*, Great Plains Toad, *Bufo cognatus* and the Northern Leopard Frog, *Rana pipiens*) and 2 reptile species (Snapping Turtle, *Chelydra serpentina* and Plains Garter Snake, *Thamnophis radix*) were recorded during the surveys. Northern Leopard Frogs had the highest site occupancy rate at 72%.

Table 8. Herpetofauna, Aquatic Plant and Dragonfly/Damselfly Species Observations for sites of the Slim Buttes Watershed Assessment. X=present at site, XX=abundant at the site.

Common Name	Scientific Name	N F Moreau #1 6/6/06	N F Moreau #2 6/7/06	S F Moreau #1 6/6/06	S F Moreau #2 6/6/06	S F Moreau #3 6/7/06	Spur Creek 6/6/06	Hay Creek 6/6/06	Jones Cr #1 6/6/06	Jones Cr #2 6/7/06	S F Grand #1 6/7/06	S F Grand #2 6/6/06	Campbell Cr 6/5/06	Bull Cr #1 6/5/06	Crooked Cr #1 6/6/06	Pine Spring Cr 6/5/06	Little MO MT 6/4/06	Little MO #2 6/5/06	Little MO #1 6/5/06
Amphibians/Reptiles																			
Plains Garter Snake	<i>Thamnophis radix</i>	0	0	X	0	X	X	0	X	0	0	0	0	0	0	0	0	0	0
Snapping Turtle (dead)	<i>Chelydra serpentina</i>	0	0	0	0	0	0	0	X	0	0	0	0	0	0	0	0	0	0
Great Plains Toad	<i>Bufo cognatus</i>	X	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Woodhouses' Toad	<i>Bufo woodhousii</i>	X	0	0	0	0	0	0	X	0	0	X	0	0	0	0	0	0	0
Plains Leopard Frog	<i>Rana pipens</i>	X	0	XX	XX	X	X	X	X	X	X	X	XX	X	X	0	X	0	0
Dragonflies																			
Common Green Darner	<i>Anax junius</i>	X	0	X	X	X	X	X	X	0	0	0	X	X	X	X	0	0	0
Common Whitetail	<i>Libellula lydia</i>	0	0	X	0	0	X	X	0	X	0	0	0	0	0	0	0	0	0
Eight-spotted Skimmer	<i>Libellula forensis</i>	0	X	X	0	X	X	X	X	0	0	0	0	0	0	0	0	0	0
Twelve-spotted Skimmer	<i>Libellula pulchella</i>	0	0	0	0	0	X	0	0	X	0	0	0	0	0	0	0	0	0
Variagated Meadowhawk	<i>Sympetrum corruptum</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X	0	X	X	X
Pale Snaketail	<i>Ophiogomphus severus</i>	0	X	0	0	0	0	0	0	X	X	X	0	0	0	0	0	X	X
Damselflies																			
Northern Bluet	<i>Enallagma cyathigerum</i>	X	X	X	X	X	X	0	X	X	X	X	XX	X	X	X	0	0	0
Familiar Bluet	<i>Enallagma civile</i>	X	0	XX	X	X	XX	X	0	XX	0	0	XX	0	0	0	X	X	X
Eastern Forktail	<i>Ischnura verticalis</i>	0	X	XX	0	X	X	X	0	X	0	0	X	X	X	0	0	0	0
Spotted Spreadingwing	<i>Lestes congener</i>	0	0	X	0	0	0	X	0	0	0	0	X	0	0	0	0	0	0
Common Spreadingwing	<i>Lestes disjunctus</i>	X	0	X	X	X	0	0	X	XX	0	0	XX	X	X	X	0	0	0
Aquatic plants																			
Big Stem Rush	<i>Scirpus sp.</i>	X	0	0	X	X	0	X	X	X	X	X	X	X	X	X	0	0	0
Cattail	<i>Typha latifolia</i>	X	0	X	0	0	0	0	0	X	0	0	0	0	0	0	0	0	0
Pondweed	<i>Potamogeton sp.</i>	0	0	X	0	X	0	0	X	0	0	0	0	0	0	0	0	0	0
Millfoil	<i>Myriophyllum sp.</i>	0	0	X	0	X	0	0	X	0	0	0	0	0	X	0	0	0	0
Spikerush	<i>Eleocharis sp.</i>	X	0	X	0	0	0	X	0	X	X	X	X	X	X	X	X	X	0
Pickrel weed	<i>Pontederia sp.</i>	0	0	X	X	X	0	0	X	0	0	0	0	0	0	0	0	0	0
Water Plantain	<i>Alisma gramineum</i>	0	0	0	0	0	0	X	0	0	0	0	0	0	0	0	0	0	0
Horsetail	<i>Equistitum sp.</i>	X	0	0	0	0	X	X	0	0	0	0	0	0	0	0	0	0	0

Site Description Summaries

Medium Prairie River Ecological Types

Medium Prairie River (AES B005) Ecological Types in order of highest biological integrity to lowest. 1) Little Missouri Montana site, 2) Little Missouri #2, 3) Little Missouri@ Camp Crook, 4) South Fork Moreau #3

Management/Threats to this ecological system include: Grazing and livestock use around the riparian areas occurs and can have strong local effects resulting in sedimentation and stream widening at cattle crossings. Introductions of game or forage fish in stock ponds anywhere in the watershed can make their way downstream to these larger prairie rivers and become permanent residents, competing with (green sunfish) or preying upon (northern pike) resident native fish species

Global Rank Comments: The number of viable occurrences is unknown, but probably somewhat rare. These prairie river ecological types are abundant in terms of river miles across the Northern Great Plains Steppe of North America, but the hydrology (i.e. water permanence) and biological integrity can be easily affected by upstream dams or diversions in the watershed. Stock ponds that are stocked with game fish, and bait bucket introductions can also contribute to the community degradation of introduced fish species.

Site Description

Little Missouri River (MT site)



Figure 10. The Little Missouri River site near Albion, MT.



Figure 11. Little Missouri River (AES B005) Medium Prairie River habitat near Albion, MT.



Figure 12. Little Missouri River (AES B005) cobble/woody debris near Albion, MT.

Location: Accessed from Stateline Rd. at bridge crossing about 6 miles Northeast of Albion, MT. Proceeded upstream ~100m to the first riffle/pool set designated as the bottom of the reach (Figure 11).

Nearest Town: Albion, Carter County, MT

Ecoregion: Northern Great Plains Steppe

Aquatic Ecological System Type: B005-Northwestern Great Plains Medium Prairie Stream, borderline Large Prairie River probably shifts around the ND border.

Key Environmental Factors: Hydrology—upstream dams or diversions in the watershed; Grazing—slight impacts, cattle on right bank.

Rare or Unique Species: No rare species, but giant floater mussel shells were documented.

Rare Features: No rare features documented.

Introduced/Exotic Species: Black bullhead, carp and green sunfish

Overall Ecological Site Condition: Good

Reach Summary: The 300 m reach consisted of 2 riffle/run/pool complexes with full flowing water connectivity. The lower pool was ~50m long (averaged 0.75m deep) and contained the deepest fish holding habitat. This stream reach has good aquatic habitat and a diversity of microhabitats, thus leading to high fish species diversity (14 species, 11 native), although an abundance & dominance of introduced species. Pools averaging 25-40m long and 8-10m wide. All substrate of the upper pool was gravel/silt dominated with some cobbles, and pool #2 was dominated by silt & gravel. Aquatic geomorphic structures and overhanging banks at the margins provided most fish habitat in this stream reach. Riparian vegetation coverage was dominated by shrubs & some willows on the immediate riparian bank with cottonwoods along the 2nd tier riparian area. Livestock use index (LUI) was low with only ~7 cow pies counted on a 75m walk of the left and right banks.

Reach Habitat Ranking: BLM= 95.8% (23 of 24) EPA RBP= 94% (188 of 200)

Reach Riparian Geomorphology: The geomorphology of this stream reach is a Rosgen F-4 with a gentle-medium slope (~1%), moderate sinuosity, riffle-pool configuration with substrate dominated by gravel and sand/silt dominated pools. Pools are slightly incised and averaged >40 cm in depth., Wetted width of the reach was 9.8m. Surrounding bank materials are finer than the channel bed materials indicating no in-stream accumulation of sediments.

Amphibian Community: 1 adult Northern Leopard Frog (NLF) present.

Fish Community: 14 fish species (11 native) were seined in the 2 riffle/run/pools. Dominant species were sand shiners, black bullheads and green sunfish. Expected dominant fish species for this stream type would have included flathead chubs, sand shiners, western silvery and plains minnows and fewer introduced species. Although most fish species expected are present and there were a good number of river carpsuckers which helped the IBI score. Presence of abundant non-natives (black bullheads and green sunfish) has shifted the IBI score lower than it would have been, but overall a good fish community.

Fish Community Quality: IBI= 88.05 O/E= 11/11 or 100% of the expected fish community.

Macroinvertebrate Community: This community consists of the Filtering Collector, Prairie Stream and Large Prairie River assemblage of macroinvertebrates (#9, 11, 37 Stagiano 2005). Over 80% of the indicator species expected were present in this sample.

Macroinvertebrate Community Quality: MT MMI= 62.5 O/E= >80%

Site Description

Little Missouri River (Site #2, Salmen Ford)



Figure 13. Little Missouri River Site #2 (AES B005) run/pool habitat near Ladner, SD.



Figure 14. Little Missouri River Site #2 (AES B005) sauger (*Sander canadensis*) an SOC in MT but not SD.



Figure 15. Little Missouri River Site #2 (AES B005) goldeyes (*Hiodon alosoides*) a sensitive indicator Medium-Large Prairie River fish species.

Location: Accessed going north on Rt. 867 out of Camp Crook, turn Right at Rt. 988 and proceed 3 mile to a dirt road on the left before Salmen Ford. Top of reach starts ~100m downstream of this ford (see photo 13) and proceeds ~300m downstream to the corner bend.

Nearest Town: Ladner, Harding County, MT

Ecoregion: Northern Great Plains Steppe (Typical)

Aquatic Ecological System Type: B005-Northwestern Great Plains Medium Prairie Stream, borderline Large Prairie River probably around the ND border.

Key Environmental Factors: Hydrology—upstream dams or diversions in the watershed; Grazing—sheep grazing on right bank looking downstream

Rare or Unique Species: The dominance of large river species (goldeyes, sauger and channel catfish)

Rare Features: Cottonwood stand with good recruitment and regeneration.

Introduced/Exotic Species: Northern pike & carp

Overall Ecological Site Condition: Good to Excellent

Reach Summary: The 300 m reach consisted of 3 riffle/run/pool complexes with full flowing water connectivity and a braided channel around an island. The uppermost pool was ~12m wide, ~50m long (averaged 0.5 m deep) and contained the most fish holding habitat, a riffle above this pool was the top of the reach. This pool was followed by a 50m deep run which divided around an island forming a braided channel (see photo). This stream reach has excellent aquatic habitat (30% of the channel depths were >0.5m), and a diversity of microhabitats leading to high fish species diversity (14 species). Pools averaging 25-40m long and 8-10m wide. Substrate of the upper pool was gravel-dominated with some silt and cobbles, and the lower pools dominated by sand/gravel. Aquatic vegetation and overhanging banks at the margins provided significant stream habitat in this stream reach. Riparian vegetation coverage was dominated by grasses and shrubs with a significant cottonwood grove with regeneration on the left bank. Livestock use index (LUI) was moderate with ~20 sheep pies counted on a 75m walk of the right bank.

Reach Riparian Ranking: BLM= 90% (22 of 24) EPA RBP= 90% (180 of 200)

Reach Riparian Geomorphology: The geomorphology of this stream reach is a Rosgen C-4 with a gentle-medium slope (~1%), moderate sinuosity, and a riffle-pool configuration with substrate dominated by gravel/cobbles and ranging to gravel-dominated pools. Pools are slightly incised and averaged >40 cm in depth, wetted width of the reach was 15.4m. Surrounding bank materials are finer than the channel bed materials.

Amphibian Community: None recorded.

Fish Community: 14 fish species (11 native) were seined in the 3 riffle/run/pools. Dominant species were goldeyes, sand shiners and channel catfish. Expected dominant fish species for this stream type would have included flathead chubs, western silvery and plains minnows. Expected fish for this stream type have been met and included the important species, sauger (Figure 14) and the intolerant goldeye (Figure 15). The presence of these species substantially raised the IBI scores, and compensated for the occurrence of 2 introduced species in this river reach, the carp and northern pike. Overall, excellent fish community.

Fish Community Quality: IBI= 87.6 O/E= 11/11 or 100% of the expected fish community.

Macroinvertebrate Community: This community consists of the Filtering Collector, Prairie Stream and Large Prairie River assemblage of macroinvertebrates (#3, 9, 11, 37 Stagliano 2005). Over 80% of the indicator species expected were present in this sample.

Macroinvertebrate Community Quality: MT MMI= 72.6 O/E= >80%

Site Description

Little Missouri River (Site #1 Camp Crook)



Figure 16. Little Missouri River Site #1 (AES B005) run/pool habitat near Camp Crook, SD



Figure 17. Little Missouri River Site #1 (AES B005) run/pool habitat looking upstream



Figure 18. Little Missouri River Site #1 (AES B005) cottonwood stand on upper terrace

Location: Accessed going north on Rt. 867 out of Camp Crook, turn Right at dirt road after 1 mile, go 1 mile east until you hit the state section fence and proceed to river. Reach is ~100m downstream of this point and ~200m upstream to the top riffle.

Nearest Town: Camp Crook, Harding County, MT

Ecoregion: Northern Great Plains Steppe (Typical)

Aquatic Ecological System Type: B005-Northwestern Great Plains Medium Prairie Stream, borderline Large Prairie River type-probably changing around the ND border.

Key Environmental Factors: Hydrology—upstream dams or diversions in the watershed; Grazing—old grazing on left bank looking downstream

Rare or Unique Species: No rare species or communities documented

Rare Features: Cottonwood stand with good recruitment and regeneration

Introduced/Exotic Species: Green sunfish and common carp

Overall Ecological Site Condition: Good

Reach Summary: The 300 m reach consisted of 1 long riffle/pool/run complex with full flowing water connectivity (Figure 16). The uppermost pool was 15-18m wide, ~50m long (averaged 0.75m deep) and contained the most diverse fish species habitat, a riffle above this pool was the top of the reach (Figure 17). This pool was followed by a 150m deep run along the incised left bank. This stream reach has good aquatic habitat and a fair diversity of microhabitats, leading to high fish species diversity (14 species, 11 native). Substrate of the upper pool was gravel and silt-dominated with some cobbles. Geomorphic structures and overhanging banks provided the most habitat in this stream reach. The riparian channel within the reach was vegetated on top, but down-cut and provided minimal shading. The incisement of the outside bend with cottonwoods on the terrace at the top of the reach can be seen in Figure 17. The upper terrace and floodplain of the left bank has a nice stand of cottonwoods (Figure 18).

Reach Riparian Ranking: BLM= 79% (19 of 24) EPA RBP= 86% (172 of 200)

Reach Riparian Geomorphology: The geomorphology of this stream reach is a Rosgen F-4 with a gentle-medium slope (<1%), moderate sinuosity, a riffle-pool configuration with substrate dominated by gravel/pebbles and gravel/silt dominated pools. The reach was slightly incised (entrenchment ratio ~1.5) and averaged ~51 cm in depth and average wetted width of the reach was 11.8m. Surrounding bank materials are finer than the channel bed materials.

Amphibian Community: No amphibians reported from this site.

Fish Community: 14 fish species (11 native) were seined in the riffle/run/pool. Dominant species were fathead minnows and sand shiners. Expected dominant fish species for this stream type would have included flathead chubs, sand shiners, western silvery and plains minnows and fewer fatheads. Although, most fish species expected are present, thus a good O/E score, the presence of non-natives and dominance of fatheads has caused a lowered IBI score and is ranked as slightly impaired. But overall a good fish community.

Fish Community Quality: IBI= 65.19 O/E= 10/11 or 92% of the expected fish community.

Macroinvertebrate Community: This community consists of the Filtering Collector, Prairie Stream and Large Prairie River assemblage of macroinvertebrates (#3, 9, 11, 37 Stagiano 2005). Over 80% of the indicator species were present in this sample.

Macroinvertebrate Community Quality: MT MMI= 63.4 O/E= >80%

Site Description

South Fork Moreau River (site #3)



Figure 19. South Fork Moreau River #3 (AES B005) pool habitat, looking downstream near Hoover, SD



Figure 20. South Fork Moreau River #3 (AES B005) run/pool habitat, looking upstream near Hoover, SD



Figure 21. South Fork Moreau River #3 (AES B005) exposed layer of dense fossils in right bank



Figure 22. South Fork Moreau River #3 (AES B005) petrified tree stumps on right bank

Location: Accessed from Route 79, Butte County Road at the bridge crossing and proceeded upstream ~100m to the first pool set designated the bottom of the reach (Figure 19).

Nearest Town: Hoover, Butte County, SD

Ecoregion: Northern Great Plains Steppe

Aquatic Ecological System Type: B005-Northwestern Great Plains Medium Prairie River

Key Environmental Factors: Hydrology—upstream dams, incised channel; Grazing—slight impacts

Rare or Unique Species: No rare species, but good riparian cottonwood stands in local landscape.

Rare Features: Petrified logs and fossil remains in the right stream bank (Figure 21 & 22).

Introduced/Exotic Species: Green sunfish

Overall Ecological Site Condition: Fair/Good

Reach Summary: The 250m reach consisted of 3 run/pool complexes with the uppermost pool being ~100m long and containing the most fish holding habitat. This stream reach has moderate aquatic habitat and a diversity of microhabitats, thus leading to high fish species diversity (12 species, 10 native). Pools averaging 10-15m long and 2.25m wide. The first 2 riffle/pool complexes proceeding upstream were deep enough to allow seining for fish, the last pool was clear and shallow enough to visibly inspect for fish and amphibians. Spacing between the pools was ~20m apart for the bottom 3, and ~100m from pool 3 to 4. All substrate of the pools was gravel dominated with some silt and cobbles and pools 1 and 2 with surrounding vegetation dominated by *Scirpus* sp. (rushes) and *Eleocharis palustris*, common spikerush. Aquatic vegetation and overhanging banks provided the most significant stream habitat in this stream reach. Livestock use index (LUI) was low with ~7 cow pies counted on a 75m walk of the left bank. Pugging and hummocking was absent in the immediate riparian reach.

Reach Riparian Ranking: BLM= 62.5% (15 of 24) EPA RBP= 64% (128 of 200)

Reach Riparian Geomorphology: The geomorphology of this stream reach is a Rosgen F-4 with a gentle-medium slope (~1%), moderate sinuosity, and a glide-pool configuration with substrate dominated by silted-cobbles and ranging from silt to gravel-dominated pools. Pools are incised and averaged >40 cm in depth, wetted width of the reach was 6.8 m. Surrounding bank materials are finer than the channel bed materials.

Amphibian Community: 1 adult Northern Leopard Frog (NLF) present in the uppermost pool and a garter snake in the riparian zone.

Fish Community: 11 fish species (9 native) were seined in the 3 run/pools. Dominant species were fathead minnows and sand shiners. Expected dominant fish species for this stream type would have included flathead chubs, sand shiners, western silvery and plains minnows and fewer fatheads. Although most fish species expected are present, thus a good O/E score, the presence of non-natives and dominance of fatheads has caused a lowered IBI score and is ranked as slightly impaired. But overall a good fish community.

Fish Community Quality: IBI= 65.19 O/E= 9/11 or 81.8% of the expected fish community.

Macroinvertebrate Community: This community consists of the Filtering Collector, Prairie Stream and Large Prairie River assemblage of macroinvertebrates (#9, 11, 12, 40 Stagiano 2005). This community was devoid of the filtering collector assemblage indicator species and few indicators of the Large Prairie River assemblage indicating that the community of this site is incomplete. Only ~60% of the indicator species were present in this sample.

Macroinvertebrate Community Quality: MT MMI= 45.6 O/E= 62%

Northwestern Great Plains Prairie Stream Ecological Types

Northwestern Great Plains Prairie Stream (AES C005) Ecological Types in order of highest biological integrity to lowest. 1) South Fork Grand #2, 2) South Fork Grand #1, 3) North Fork Moreau River #2, 4) Jones Creek #2, 5) Crooked Creek, 6) South Fork Moreau River #2, 7) Bull Creek

Management/Threats to this ecological system include: Grazing and livestock use around the riparian areas occurs and can have strong local effects resulting in sedimentation and stream widening at cattle crossings. Introductions of game or forage fish in stock ponds anywhere in the watershed can make their way downstream to these perennial prairie rivers and become permanent residents, competing with (green sunfish) or preying upon (northern pike) resident native fish species.

Global Rank Comments: The number of viable occurrences is unknown, but probably rare. Although, these systems occur higher in the watershed, and not as rare as a high quality Medium Prairie River. These prairie river ecological types are abundant in terms of river miles across the Northern Great Plains Steppe of North America, but the hydrology (i.e. water permanence) can be easily affected by upstream dams or diversions in the watershed. Stock ponds that are stocked with game fish, and bait bucket introductions can also contribute to the community degradation brought about by the introduced fish species.

Site Description

South Fork Grand River (site #2) (on report cover)



Figure 23. South Fork Grand River #2 (AES C005) with reference condition landscape and local-reach overview from bridge



Figure 24. South Fork Grand River #2 (AES C005) bottom of reach looking upstream



Figure 25. South Fork Grand River #2 (AES C005) bottom of reach looking downstream

Location: Accessed from Rt. 79 at bridge crossing and proceeded upstream ~100m to the first riffle/pool set designated the bottom of the reach.

Nearest Town: Reva, Harding County, SD

Ecoregion: Northern Great Plains Steppe (Typical)

Aquatic Ecological System Type: C005-Northwestern Great Plains Prairie Stream

Key Environmental Factors: Hydrology—upstream dams or diversions in the watershed; Grazing—slight impacts

Rare or Unique Species: No rare species, but excellent fish community

Rare Features: Excellent Prairie Stream Habitat

Introduced/Exotic Species: Black bullhead and green sunfish (rare)

Overall Ecological Site Condition: Good to Excellent

Reach Summary: The 300 m reach consisted of 3 riffle/run/pool complexes with full flowing water connectivity. The uppermost pool was ~30m long and contained the most fish holding habitat. This stream reach has excellent aquatic habitat and a diversity of microhabitats, thus leading to high fish species diversity (11 species, 9 native). Pools averaging 20-25m long and 4.5m wide. The first 2 riffle/pool complexes proceeding upstream were the deeper habitat for fish seining, the last pool shallow enough to visibly inspect for fish and amphibians. Spacing between the pools was ~20m apart for the bottom 3, and ~100m from pool 3 to 4. All substrate of the pools was gravel dominated with some silt and cobbles. Aquatic geomorphic features and overhanging banks provided the most significant stream habitat in this reach. Vegetation coverage along the riparian stream channel was dominated by grasses and fully intact. Livestock use index (LUI) was low with 10 cow pies counted on a 75m walk of both left and right banks.

Reach Riparian Ranking: BLM= 95.8% (23 of 24) EPA RBP= 94.5 % (189 of 200)

Reach Riparian Geomorphology: The geomorphology of this stream reach is a Rosgen C-3b with a gentle-medium slope (~1%), moderate sinuosity, a riffle-pool configuration with substrate dominated by cobbles and ranging to gravel-dominated pools. Pools are slightly incised and averaged >40 cm in depth, wetted width of the reach was 8.2. Surrounding bank materials are finer than the channel bed materials.

Amphibian Community: 1 adult Woodhouse's toad present along the uppermost pool.

Fish Community: 12 fish species were seined in the 3 riffle/run/pools. Dominant species were the flathead chubs, plains minnows and sand shiners. Expected fish for this stream type would have been fathead minnows and brook sticklebacks, so the brassy minnows were a nice surprise.

Fish Community Quality: IBI= 103.6 O/E= 9/7.75 or 116% of the expected fish community.

Macroinvertebrate Community: This community consists of the Filtering Collector, Prairie Stream and Large Prairie River assemblage of macroinvertebrates (#9, 11, 37 Stagiano 2005). Over 80% of the indicator species were present in this sample.

Macroinvertebrate Community Quality: MT MMI= 79.7 O/E= >80%

Site Description

South Fork Grand River (site #1)



Figure 26. South Fork Grand River #1 (AES C005) looking downstream towards county bridge



Figure 27. South Fork Grand River #1 (AES C005) bottom riffle of reach looking upstream



Figure 28. South Fork Grand River #1 (AES C005) top 150m long pool



Figure 29. South Fork Grand River #1 (AES C005) catfish seined in the top pool

Location: Accessed from County Road (Old Route 20) 12.5 miles northeast from at the bridge crossing (Figure 26) and proceeded upstream above vehicle ford to the first riffle/pool set designated the bottom of the reach (Figure 27).

Nearest Town: Buffalo, Harding County, SD

Ecoregion: Northern Great Plains Steppe

Aquatic Ecological System Type: C005-Northwestern Great Plains Perennial Stream

Key Environmental Factors: Hydrology—upstream dams or diversions in tributaries of the watershed;
Grazing—slight impacts

Rare or Unique Species: No rare species, but an excellent fish community

Rare Features: No rare features documented

Introduced/Exotic Species: Black bullhead and green sunfish (rare)

Overall Ecological Site Condition: Good to Excellent

Reach Summary: The 300 m reach consisted of 3 riffle/run/pool complexes (full flowing connectivity) with the uppermost pool being ~100m long and containing the most fish holding habitat. This stream reach has excellent aquatic habitat and a diversity of microhabitats, thus leading to high fish species diversity (12 species, 10 native). Pools averaging 10-15m long and 2.25m wide. The first 2 riffle/pool complexes proceeding upstream were deep enough to allow seining for fish, the last pool was clear and shallow enough to visibly inspect for fish and amphibians. All substrate of the pools was gravel dominated with some silt and cobbles and pools 1 and 2 with surrounding vegetation dominated by *Scirpus* sp. (rushes) and *Eleocharis palustris*, common spikerush. Aquatic vegetation and overhanging banks provided the most significant stream habitat in this stream reach. Grasses, although sparse in places (Figure 26), comprised a large percentage of vegetation coverage along the riparian stream channel. Livestock use index (LUI) was moderate with ~20 cow pies counted on a 75m walk of the left bank. Pugging and hummocking was minimal.

Reach Riparian Ranking: BLM= 95.8% (23 of 24) EPA RBP= 93.5 % (188 of 200)

Reach Riparian Geomorphology: The geomorphology of this stream reach is a Rosgen C-3b with a gentle-medium slope (~1.5%), moderate sinuosity, a riffle-pool configuration with substrate dominated by cobbles and ranging to gravel-dominated pools. Pools are slightly incised and averaged >40 cm in depth, wetted width of the reach was . Surrounding bank materials are finer than the channel bed materials.

Amphibian Community: 1 Adult Northern Leopard Frog (NLF) observed in the uppermost pool.

Fish Community: 12 fish species (9 native) were seined in the 3 riffle/run/pools. Dominant species were the flathead chubs, plains minnows and sand shiners. Expected fish for this stream type have been met, although a couple of introduced species were present (black bullhead and green sunfish). These probably originated from the Jones Creek stock pond reservoirs that can contribute introduced species during high flow events.

Fish Community Quality: IBI= 99.8 O/E= 9/7.75 or 116% of the expected fish community.

Macroinvertebrate Community: This community consists of the Filtering Collector, Prairie Stream and Large Prairie River assemblage of macroinvertebrates (#9, 11, 37 Stagiano 2005). The expected community indicator species are present and this site ranked high with the MT MMI. Over 80% of the indicator species were present in this sample.

Macroinvertebrate Community Quality: MT MMI= 69.8 O/E= >80%

Site Description

North Fork Moreau River (site #2)



Figure 30. North Fork Moreau River (AES C005) Marty Bridge site not sampled



Figure 31. North Fork Moreau River #2 (AES C005) upper riffle looking downstream



Figure 32. North Fork Moreau River #2 (AES C005) bottom of reach looking upstream

Location: Accessed from Rt 79 bridge, 1.2 miles north of County Rd. 732 and proceeded upstream ~200 m to the bottom set of pools. Another site in the vicinity was visited off the Marty Rd. bridge (Figure 30), which appeared to be similar in geomorphology and condition to this site, but was not sampled.

Nearest Town: Hoover, Butte County, SD

Ecoregion: Northwestern Great Plains (Typical)

Aquatic Ecological System Type: C005-Northwestern Great Plains Perennial Stream

Key Environmental Factors: Hydrology—upstream dams or diversions in the watershed; Grazing—slight impacts

Rare or Unique Species: No rare species or communities documented

Rare Features: No rare features documented

Introduced/Exotic Species: Black bullhead, golden shiner and green sunfish (all rare)

Overall Ecological Site Condition: Good

Reach Summary: The 300 m reach consisted of 2 riffle/run/pool complexes (full flowing connectivity) with the lowermost pool being ~100m long, ~40cm deep and containing the most fish holding habitat. This stream reach has moderate quality habitat and a fair diversity of microhabitats, thus leading to high fish species diversity (11 species, 8 native). All substrate of the top riffle/run was gravel dominated with some silt and cobbles and pools 1 and 2 with surrounding vegetation dominated by *Scirpus* sp. (rushes) and *Eleocharis palustris*, common spikerush (Figure 31). Aquatic geomorphic features and overhanging banks provided the most significant stream habitat in this stream reach. Vegetation coverage along the riparian stream channel was largely intact and dominated by grasses. Livestock use index (LUI) was low with ~10 cow pies counted on a 75m walk of the left & right banks. Pugging and hummocking was minimal.

Reach Riparian Ranking: BLM= 95% (23 of 24) EPA RBP= 89% (178 of 200)

Reach Riparian Geomorphology: The geomorphology of this stream reach is a Rosgen C-4 with a gentle-medium slope (~1%), moderate sinuosity, a riffle/run/pool configuration with substrate dominated by gravels & cobbles and ranging to gravel to silt-dominated pools. Pools are slightly incised and averaged >40 cm in depth, wetted width of the reach was 4.4m. Surrounding bank materials are finer than the channel bed materials and the bluff bank upstream (Figure 32) probably contributes sediments in high flow events.

Amphibian Community: 1 adult Northern Leopard Frog (NLF) observed in the uppermost pool.

Fish Community: 11 fish species (8 native) were seined in the 2 riffle/run/pools. Dominant species were the plains minnows, sand shiners and flathead chubs, which are the expected fish for this stream type. Although a few introduced species were present (black bullhead, golden shiners and green sunfish), they were not abundant and did not have a large detrimental effect on the IBI, which was an excellent score.

Fish Community Quality: IBI= 90.3 O/E= 8/7.5 or 103% of the expected fish community.

Macroinvertebrate Community: This community consists of the Filtering Collector, Prairie Stream and Large Prairie River assemblage of macroinvertebrates (#9, 11, 37 Stagliano 2005). Over 80% of the indicator species were present in this sample.

Macroinvertebrate Community Quality: MT MMI= 57.1 O/E= >80%

Site Description

Jones Creek (site #2)



Figure 33. Jones Creek #2 (AES C005) pool upstream from road crossing



Figure 34. Jones Creek #2 (AES C005) pools below the road crossing



Figure 35. Jones Creek #2 (AES C005) typical green sunfish, an introduced species



Figure 36. Jones Creek #2 (AES C005) riffle downstream from road crossing

Location: Accessed from County Road (Old Route 20) 12.5 miles northeast from Buffalo, SD, approximately ½ mile before the old S.F. Grand Bridge crossing. Then heading north a tenth of a mile on a 2-track to a stream crossing and proceeded upstream ~10m to the first pool and downstream 100m for the bottom series of pools of the reach.

Nearest Town: Buffalo, Harding County, SD

Ecoregion: Northern Great Plains Steppe

Aquatic Ecological System Type: C005-Northwestern Great Plains Perennial Stream, but due to reduced hydrology from upstream dams, trending towards a D005 Northwestern Great Plains Intermittent Stream

Key Environmental Factors: Hydrology—upstream dams or diversions in the watershed; Grazing—moderate impacts

Rare or Unique Species: No rare species or communities documented

Rare Features: No rare features documented

Introduced/Exotic Species: Black & yellow bullhead, green sunfish

Overall Ecological Site Condition: Good-with high restoration potential

Reach Summary: The 150 m reach consisted of a 50m run/pool complex above the road crossing and a 100m series of riffle/run/pools below the crossing. This road crossing could really use a culvert, as the dirt fill road is causing hydrologic modifications and accumulating silt in the upper pool. The upper pool being ~30m long and 5m wide contained the deepest fish habitat, albeit silted (Figure 33). This stream reach has moderate-quality aquatic habitat and good fish species diversity (8 fish species, 5 natives). Pools below the road averaged 5-10m long and 2.25m wide (Figure 34). Spacing between the pools was fully connected. All substrate of the pools was silt dominated with some gravel/pebble in the runs between them; the lower pools contain pebble/cobble riffle areas between them (Figure 36), which provided the highest habitat diversity for macroinvertebrates. The surrounding vegetation dominated by *Scirpus* sp. (rushes) and *Eleocharis palustris*, common spikerush. Aquatic vegetation and overhanging banks provided the most significant stream habitat in this stream reach. Livestock use index (LUI) was moderate with ~15 cow pies counted on a 75 m walk of the left bank. Pugging and hummocking was minimal.

Reach Riparian Ranking: BLM= 80% (20 of 24) EPA RBP= 87.5% (175 of 200)

Reach Riparian Geomorphology: The geomorphology of this stream reach is a Rosgen E-4 with a gentle-medium slope (~1%), moderate sinuosity, a riffle-pool configuration with substrate dominated by gravels and silted-embedded pools. Pools are slightly incised and averaged >30 cm in depth, wetted width of the reach was 3.4. Surrounding bank materials are similar to the channel bed materials indicating a balance of sediment accumulation locally and upstream in the reach, except for the hydrologic change caused by the road crossing.

Amphibian Community: 1 Adult Northern Leopard Frog (NLF) present in the uppermost pool.

Fish Community: 8 fish species (5 natives) were seined in the 2 riffle/run/pool sequences. Dominant species were the sand shiners, fathead minnows and flathead chubs. Expected fish for this stream type have almost been met, although a few introduced species were present (Black/Yellow Bullhead and green sunfish (Figure 35)). These probably originated from the upstream Jones Creek stock ponds that can contribute introduced species during high flow events. Only the one introduced species (green sunfish) was seined below the road, possibly indicating the road may be a barrier to bullhead from getting downstream.

Fish Community Quality: IBI= 88.25 O/E= 5/7.5 or 66.7% of the expected fish community.

Macroinvertebrate Community: This community of intermittent prairie stream invertebrates consisted of the Prairie Pool assemblage (#12, Stagliano 2005) and the Prairie Stream assemblage found in the cobble riffle areas (#9, Stagliano 2005). Over 80% of the indicator species were present in this sample.

Macroinvertebrate Community Quality: MT MMI= 58.9 O/E= >80% of the expected community.

Site Description

Crooked Creek (tributary to the North Fork Grand)



*Figure 37. Crooked Creek (AES C005)
looking upstream near Cox Church*

Location: Accessed from County Rd. 733 @ Cox Church, 7 miles west of Rt 85, ~20 miles north of Buffalo.

Nearest Town: Buffalo, Harding County, SD

Ecoregion: Northern Great Plains Steppe

Aquatic Ecological System Type: C005-Northwestern Great Plains Perennial Stream, but due to reduced hydrology from upstream dams, trending towards a D005 Northwestern Great Plains Intermittent Stream

Key Environmental Factors: Hydrology—upstream and downstream dams in the watershed; Oil and gas drilling in the watershed; Grazing—slight impacts

Rare or Unique Species: No rare species documented

Rare Features: No rare features documented

Introduced/Exotic Species: Black bullhead & green sunfish (rare, not abundant)

Overall Ecological Site Condition: Fair/Good

Reach Summary: The 100 m reach consisted of 1 run/pool complex with the pool being ~90m long and fairly incised (Figure 37). This site contains no riffle or erosional areas decreasing the ability to provide habitat for other C005 fish species. The stream reach has decent aquatic habitat and is set in a quality

local landscape. But the water quality or some other factor is definitely affecting the fish community's low integrity ratings. All substrate of the reach was silt dominated with some cobble associated with the bridge. Adjacent riparian vegetation was dominated by *Eleocharis palustris*, the common spikerush and grasses which provided excellent bank stability (Figure 37). Aquatic submerged vegetation provided the most significant stream habitat in this reach contributing to the abundant brook sticklebacks. Livestock use index (LUI) was low here with zero cow pies counted on a 50 m walk of the left & right banks. Pugging and hummocking was absent.

Reach Riparian Ranking: BLM= 66.7% (16 of 24) EPA RBP= 67.5% (135 of 200)

Reach Riparian Geomorphology: The geomorphology of this stream reach is a Rosgen F6 with a gentle slope (<1%), low sinuosity, a run-pool configuration with silt-dominated runs and pools. Pools are slightly incised and averaged ~30 cm in depth, wetted width of the reach averaged 5m. Surrounding bank materials are similar to the channel bed materials indicating a balance of accumulation locally and upstream in the reach.

Amphibian Community: 20 Adult Northern Leopard Frog (NLF) present. Undetermined toad, *Bufo* sp., tadpoles (prob. Woodhouse's) also present in pool.

Fish Community: 5 fish species (3 natives) were seined in the pools. Dominant species are the fathead minnow and brook stickleback and the white sucker was also present. Expected fish for this stream type have not been met, and the fish IBI is showing moderate impairment. This indicates that habitat quality or water quality are definitely affecting the fish community.

Fish Community Quality: IBI= 49.5 O/E= 2/2.4 or 83% of the expected indicator fish species.

Macroinvertebrate Community: This community of prairie stream invertebrates consists of the Prairie Pool assemblage (#12, Stagliano 2005). The community indicator species are characterized by tolerant, damselfly taxa, *Coenagrion/Enallagma* sp. *Enallagma civile*, *Lestes* and *Ishnura*, the crustaceans (*Hyaella* and *Gammarus*), many genera and species of the water boatman (Corixidae: *Sigara alternata*, *Trichocorixa nais*, and *Corisella*), the snails (*Physella*, *Gyraulus*, and *Stagnicola*), mayflies (*Caenis* and *Callibaetis*), and beetles (*Oreodytes*, *Laccophilus*, *Hydroporus* and *Hygrotus*). As the complexity of the pool habitat decreases the clinger habitat species are lost, such as the damselflies and many of the water boatman taxa. Over 80% of the indicator species were present in this sample.

Macroinvertebrate Community Quality: MT MMI= 39.5 O/E= 80%

Site Description

South Fork Moreau River (site #2)



Figure 38. South Fork Moreau River #2 (AES C005) pool habitat, looking upstream near Rte. 85 bridge



Figure 39. South Fork Moreau River #2 (AES C005) pool habitat, top of reach



Figure 40. South Fork Moreau River #2 (AES C005) pool habitat, cottonwood trees top of reach

Location: Accessed from Rt 85, ~10 miles south of Redig at the bridge crossing and proceeded upstream (west) ~50m to the first pool set designated the bottom of the reach (Figure 38).

Nearest Town: Redig, Harding County, SD

Ecoregion: Northern Great Plains Steppe

Aquatic Ecological System Type: C005-Northwestern Great Plains Perennial Stream

Key Environmental Factors: Hydrology—upstream beaver dams; Grazing—slight impacts; Geomorphology—incised channel, unconsolidated substrate

Rare or Unique Species: Iowa darters were documented at the downstream end of reach.

Rare Features: Dead sheep hanging in a tree near top of reach, shows hydrologic extremes (Figure 40)

Introduced/Exotic Species: Dominated by Black bullhead and green sunfish

Overall Ecological Site Condition: Poor/Fair

Reach Summary: The 300 m reach consisted of 1 long pool complex with the uppermost 100m of the pool being deepest and most incised (Figure 39). There were some areas of submerged aquatic vegetation that provided most of the fish holding habitat, but unconsolidated knee-deep silt and chest-deep (1-1.5m) channel depths made seining difficult. This stream reach has been overtaken by introduced species and the aquatic habitat is not conducive to a typical C005 fish community (e.g., no stable substrate). All substrate of the pools was silt dominated with some clay. Riparian vegetation was dominated by shrubs & grasses, but there were a few dying cottonwoods on the right bank (Figure 39, 40). Aquatic vegetation and overhanging banks provided the most significant stream habitat in this stream reach. Livestock use index (LUI) was moderate with ~20 cow pies counted on a 75m walk of the left bank. Pugging and hummocking was especially noticeable in the lower pool area where the cows have a stream crossing.

Reach Riparian Ranking: BLM= 50% (12 of 24) EPA RBP= 47.5 % (97 of 200)

Reach Riparian Geomorphology: The geomorphology of this stream reach is a Rosgen G-6 with a gentle slope (~0.5%), moderate sinuosity, an unstable, degrading run-pool configuration with unconsolidated, erodible substrate dominated silts and clays. Pools are moderately incised and averaged >75 cm in depth, wetted width of the reach was 4.5m. Surrounding fine bank materials are similar to the channel bed materials and riparian vegetation needs to be dense to provide bank stabilization (Figure 39).

Amphibian Community: 1 adult Northern Leopard Frog (NLF) present in the uppermost pool.

Fish Community: 5 fish species (3 native) were seined in the 300m pool complex. Dominant species were fathead minnows and black bullheads. Expected fish for this stream type would be flathead chubs, plains minnows and sand shiners so the expected community was not met.

Fish Community Quality: IBI= 34.9 O/E= 38.7% of expected fish community.

Macroinvertebrate Community: This community was dominated by the intermittent prairie stream invertebrates of the Prairie Pool assemblage (#12, Stagliano 2005). The community indicator species should have contained members of the Prairie Stream macroinvertebrates (#9 Stagliano 2005). Only 40% of the indicator species were present in this sample.

Macroinvertebrate Community Quality: MT MMI=22.3 O/E=40% of expected macro community.

Site Description

Bull Creek (tributary to the South Fork Grand)



Figure 41. Bull Creek (AES C005) a silt-impaired Great Plains stream near Brown Rd.

Location: Accessed from County Rd. 733, 7 miles west of Rt 85, ~20 miles northwest of Buffalo.

Nearest Town: Buffalo, Harding County, SD

Ecoregion: Northern Great Plains Steppe

Aquatic Ecological System Type: C005-Northwestern Great Plains Perennial Stream, but due to reduced hydrology from upstream dams, trending towards a D005 Northwestern Great Plains Intermittent Stream

Key Environmental Factors: Hydrology—upstream and downstream dams in the watershed; cattle grazing in the watershed

Rare or Unique Species: No rare species documented

Rare Features: No rare features documented

Introduced/Exotic Species: None

Overall Ecological Site Condition: Poor/Fair

Reach Summary: The 100 m reach consisted of 1 run/pool complex with the pool being ~90m long and fairly incised (Figure 41). This site contains no riffle or erosional areas decreasing the ability to provide habitat for other C005 fish species. The stream reach has intact riparian habitat and is set in a quality local landscape. But the channel condition and accumulation of silt is definitely affecting the fish and macroinvertebrate community's low integrity ratings. Bottom substrate of the reach was 0.5m deep, unconsolidated silt, which made sampling difficult. The immediate surrounding vegetation was dominated by *Scirpus* sp. (rushes) and *Eleocharis palustris*, common spikerush. Riparian zone consisted entirely of grasses. Livestock use index (LUI) was low with 5 cow pies counted on a 50 m walk of the left & right banks. Pugging and hummocking was minimal.

Reach Riparian Ranking: BLM= 50% (12 of 24) EPA RBP= 55% (110 of 200)

Reach Riparian Geomorphology: The geomorphology of this stream reach is a Rosgen F-6 with a gentle slope (<1%), low sinuosity, a run-pool configuration with silt-dominated runs and pools. Pools are slightly incised and averaged ~40 cm in depth, wetted width of the reach averaged 5m. Surrounding bank materials are coarser than the channel bed materials indicating an accumulation of sediments locally and upstream in the reach.

Amphibian Community: 2 adult Northern Leopard Frog (NLF) were recorded.

Fish Community: 2 fish species (1 native) were seined in the pool. Dominant species was the fathead minnow. Expected fish for this stream type have not been met, and the fish IBI is showing moderate impairment. This indicates that habitat quality or water quality are definitely affecting the fish community.

Fish Community Quality: IBI= 43.6 O/E= 50% of the expected indicator fish species.

Macroinvertebrate Community: This community of prairie stream invertebrates consists of the impaired Prairie Pool assemblage (#12, Stagliano 2005). The community indicator species are characterized by tolerant, damselfly taxa, *Coenagrion/Enallagma sp. Enallagma civile, Lestes and Ishnura*, the crustaceans (*Hyaella and Gammarus*), many genera of the water boatman (Corixidae: *Sigara alternata, Trichocorixa nais, and Corisella*), the snails (*Physella, Gyraulus, and Stagnicola*), mayflies (*Caenis and Callibaetis*), and beetles (*Oreodytes, Laccophilus, Hydroporus and Hygrotus*). As the complexity of the pool habitat decreases the clinger habitat species are lost, such as the damselflies and many of the water boatman taxa. Only 50% of the indicator species were present in this sample.

Macroinvertebrate Community Quality: MT MMI= 24.8 O/E= 50%

Intermittent Prairie Stream Ecological Types

Intermittent Prairie Stream Ecological Types (AES code D005) in order of highest biological integrity to lowest. 1) North Fork Moreau site #1, 2) South Fork Moreau site #1; 3) Campbell Creek, 4) Spur Creek, 5) Hay Creek, 6) Jones Creek #1

Management/Threats: Grazing and livestock use around the riparian areas occurs and can have strong local effects resulting in sedimentation and stream widening at cattle crossings. This can be especially detrimental during the non-connective, drying period when intensive riparian cattle usage can trample banks, and hummock saturated soils having implications for downstream connectivity the following year. Hydrology can be easily affected in this ecological system by upstream dams or diversions in the watershed because it is on such a tenuous edge of existence.

Global Rank Comments: The number of viable occurrences is unknown, but probably abundant. These prairie stream ecosystems are abundant across the Northern Great Plains Steppe of North America, but the hydrology (i.e. water permanence) can be easily affected by upstream dams or diversions in the watershed. Stock ponds that are stocked with game fish can also contribute to the community degradation of introduced fish species.

Site Description

North Fork Moreau River (site #1)



Figure 42. North Fork Moreau River #1 (AES D005) pool #3 looking upstream



Figure 43. North Fork Moreau River #1 (AES D005) pool #2 looking upstream

Location: Accessed from Rt 85 bridge and proceeded upstream to the first set of pools.

Nearest Town: Redig, Harding County, SD

Ecoregion: Northwestern Great Plains

Aquatic Ecological System Type: D005-Northwestern Great Plains Intermittent Stream

Key Environmental Factors: Hydrology—upstream dams or diversions in the watershed; Grazing—moderate impacts

Rare or Unique Species: No rare species or communities documented

Rare Features: No rare features documented

Introduced/Exotic Species: Smooth brome was documented

Overall Ecological Site Condition: Fair

Reach Summary: The 300 m reach contained 4 pools averaging 10-15m long and 2.25m wide and lacked connectivity. The first 3 proceeding upstream were deep enough to allow seining for fish, the last pool was clear and shallow enough to visibly inspect for fish and amphibians. Spacing between the pools was ~20m apart for the bottom 3, and ~100m from pool 3 to 4. All substrate of the pools was silt and fine sediments (<2mm) and pools 1 and 2 contained *Typha latifolia* stands with surrounding vegetation

dominated by *Scirpus* sp. (rushes) and *Eleocharis palustris*, common spikerush. Aquatic vegetation and overhanging banks provided the most significant stream habitat in this stream reach. *Equisetum* sp. (Horsetails) also comprised a large percentage of vegetation coverage along the riparian stream channel between pools 2-4. Livestock use index (LUI) was moderate with ~20 cow pies counted on a 75m walk of the left bank. Pugging and hummocking was especially noticeable in the first pool area where the cows have a stream crossing, and upstream at the 275m mark just below pool 4.

Reach Habitat Ranking: BLM= 71 % (17 of 24) EPA RBP= 80 % (160 of 200)

Reach Riparian Geomorphology: The geomorphology of this stream reach is roughly a Rosgen E-6 with a gentle slope (<2%), moderate sinuosity, a glide-pool configuration and substrate ranging from silt-dominated pools and sand to pebbles in the dried connecting glides. Pools are quite incised and averaged >50 cm in depth.

Amphibian Community: 1 adult Northern Leopard Frog, *Rana pipiens* (NLF) present. Evidence of breeding amphibians was present in NLF and Great Plains Toad, *Bufo cognatus* tadpoles.

Fish Community: 2 fish species (Fathead and brassy minnows) were seined in the 3 pools. Expected dominant fish for this stream type would have been fathead minnows and brook sticklebacks, so the brassy minnows were a nice surprise.

Fish Community Quality: IBI= 51.5 O/E= 2/2.4 or 75% complete.

Macroinvertebrate Community: This community of prairie stream invertebrates consists of the impaired Prairie Pool assemblage (#12, Stagliano 2005). The community indicator species are characterized by tolerant, damselfly taxa, *Coenagrion/Enallagma* sp. *Enallagma civile*, *Lestes* and *Ishnura*, the crustaceans (*Hyaella* and *Gammarus*), many genera of the water boatman (Corixidae: *Sigara alternata*, *Trichocorixa nais*, and *Corisella*), the snails (*Physella*, *Gyraulus*, and *Stagnicola*), mayflies (*Caenis* and *Callibaetis*), and beetles (*Oreodytes*, *Laccophilus*, *Hydroporus* and *Hygrotus*). As the complexity of the pool habitat decreases the clinger habitat species are lost, such as the damselflies and many of the water boatman taxa. Only 60% of the indicator species were present in this sample.

Macroinvertebrate Community Quality: MT MMI= 28 O/E= 60%

Site Description

South Fork Moreau River (site #1)



Figure 44. South Fork Moreau River #1 (AES D005) vegetative pool habitat, looking from bridge



Figure 45. South Fork Moreau River #1 (AES D005) beaver dam pool habitat



Figure 46. South Fork Moreau River #1 (AES D005) pool habitat looking up

Location: Accessed from Butte County Road at the bridge crossing ~3 miles west of Rte. 85 and proceeded upstream to the first pool set designated the bottom of the reach.

Nearest Town: Redig, Harding County, SD

Ecoregion: Northern Great Plains Steppe

Aquatic Ecological System Type: D005-Northwestern Great Plains Intermittent Stream trending towards a Great Plains prairie stream if downstream connectivity is maintained.

Key Environmental Factors: Hydrology—upstream beaver dams; Grazing—moderate impacts

Rare or Unique Species: Iowa Darter

Rare Features: No rare features documented

Introduced/Exotic Species: Yellow bullhead, golden shiner and green sunfish

Overall Ecological Site Condition: Fair

Reach Summary: The 250m reach consisted of 3 run/pool complexes with the uppermost pool being ~100m long and containing the most fish holding habitat. This stream reach has moderate aquatic habitat with extensive beds of macrophytes, beaver dam complexes in the reach, without which, the pool would have been smaller and disconnected. Pools averaging 10-15m long and 2.25m wide. The first 2 riffle/pool complexes proceeding upstream were deep enough to allow seining for fish, the last pool was clear and shallow enough to visibly inspect for fish and amphibians. Spacing between the pools was ~20m apart for the bottom 3, and ~100m from pool 3 to 4. All substrate of the pools was silt dominated with surrounding vegetation dominated by *Scirpus* sp. (rushes) and *Eleocharis palustris*, common spikerush. Aquatic vegetation and overhanging banks provided the most significant stream habitat in this stream reach. Livestock use index (LUI) was moderate with ~20 cow pies counted on a 75m walk of the left bank. Pugging and hummocking was especially noticeable in the first pool area where the cows have a stream crossing near the beaver dam.

Reach Riparian Ranking: BLM= 66.7% (16 of 24) EPA RBP= 69.5 % (139 of 200)

Reach Riparian Geomorphology: The geomorphology of this stream reach is a Rosgen F-6 with a gentle-medium slope (~1%), moderate sinuosity, a run-pool configuration with substrate dominated by cobbles and ranging to gravel-dominated pools. Pools are slightly incised and averaged >40 cm in depth, wetted width of the reach was . Surrounding bank materials are finer than the channel bed materials.

Amphibian Community: 20-30 adult Northern Leopard Frogs (NLF) were collected throughout the reach.

Fish Community: 7 fish species (4 natives) were seined in the 3 pools. Dominant fish species was the fathead minnow. Expected fish for this stream type would have been fathead minnows, brassy minnows and brook sticklebacks, so the additional species were a surprise, especially the Iowa darter, unfortunately 3 non-native species were collected reducing the quality of the fish community and the IBI.

Fish Community Quality: IBI= 56.65 O/E= 51.6%

Macroinvertebrate Community: Macroinvertebrate Community: This community of intermittent prairie stream invertebrates consists of the Prairie Pool assemblage (#12, Staglano 2005). The community indicator species are characterized by tolerant, damselfly taxa, *Coenagrion/Enallagma* sp. *Enallagma civile*, *Lestes* and *Ishnura*, the crustaceans (*Hyalella* and *Gammarus*), many genera and

species of the water boatman (Corixidae: *Sigara alternate*, *Trichocorixa nais*, and *Corisella*), the snails (*Physella*, *Gyraulus*, and *Stagnicola*), mayflies (*Caenis* and *Callibaetis*), and beetles (*Oreodytes*, *Laccophilus*, *Hydroporus* and *Hygrotus*). As the complexity of the pool habitat decreases the clinger habitat species are lost, such as the damselflies and many of the water boatman taxa. Only 65% of the indicator species were present in this sample.

Macroinvertebrate Community Quality: MT MMI= 35.6 O/E= 65%

Site Description

Campbell Creek (tributary to Bull Creek, South Fork Grand)



Figure 47. Campbell Creek (AES D005) pool looking downstream towards Brown's Pond



Figure 48. Campbell Creek (AES D005) pool looking upstream towards inlet

Location: Accessed from Johnson Rd. 4.5 miles NW of Rt 85. Follow until you reach the National Forest section and drop in upstream of Brown's Pond.

Nearest Town: Buffalo, Harding County, SD

Ecoregion: Northern Great Plains Steppe

Aquatic Ecological System Type: D005-Northwestern Great Plains Intermittent Stream

Key Environmental Factors: Hydrology—upstream and downstream dams in the watershed;
Grazing—slight impacts

Rare or Unique Species: No rare species documented

Rare Features: No rare features documented

Introduced/Exotic Species: None

Overall Ecological Site Condition: Good

Reach Summary: The 50 m reach consisted of 1 run/pool complex with the pool being ~45m long and backed up as the top of Brown's Pond goes from lotic to lentic. This site is fully on National Forest ownership. The stream reach has decent aquatic habitat and low species diversity (2 fish species), but the brook sticklebacks were abundant. All substrate of the reach was silt dominated with some embedded gravel in the run upstream. The surrounding vegetation was dominated by *Scirpus* sp. (rushes) and *Eleocharis palustris*, common spikerush. Aquatic vegetation provided the most significant stream habitat in this reach. Livestock use index (LUI) was low here with 10 cow pies counted on a 50 m walk of the left & right banks. Pugging and hummocking was especially noticeable upstream of the fence separating the lower pool area from the actual stream inflow.

Reach Habitat Ranking: BLM= 71% (17 of 24) EPA RBP= 74% (148 of 200)

Reach Riparian Geomorphology: The geomorphology of this stream reach is a Rosgen F6 with a gentle slope (<1%), low sinuosity, a run-pool configuration with silt-dominated runs and pools. Pools are slightly incised and averaged ~30 cm in depth, wetted width of the reach averaged 5m. Surrounding bank materials are similar to the channel bed materials indicating a balance of accumulation locally and upstream in the reach.

Amphibian Community: 20 adult Northern Leopard Frog (NLF) present. Undetermined toad, *Bufo* sp., tadpoles (prob. Woodhouse's) also present in pool.

Fish Community: 2 fish species were seined in the pool. Dominant species was the brook stickleback and the fathead minnow was also present. Expected fish for this stream type have almost been met, although the fish IBI is still showing slight impairment.

Fish Community Quality: IBI= 62.05 O/E= 2/2.4 or 83% of the expected indicator fish species.

Macroinvertebrate Community: This community of intermittent prairie stream invertebrates consists of the Prairie Pool assemblage (#12, Stagliano 2005). The community indicator species are characterized by tolerant, damselfly taxa, *Coenagrion/Enallagma* sp. *Enallagma civile*, *Lestes* and *Ishnura*, the crustaceans (*Hyaella* and *Gammarus*), many genera and species of the water boatman (Corixidae: *Sigara alternata*, *Trichocorixa nais*, and *Corisella*), the snails (*Physella*, *Gyraulus*, and *Stagnicola*), mayflies (*Caenis* and *Callibaetis*), and beetles (*Oreodytes*, *Laccophilus*, *Hydroporus* and *Hygrotus*). As the complexity of the pool habitat decreases the clinger habitat species are lost, such as the damselflies and many of the water boatman taxa. Over 80% of the indicator species were present in this sample.

Macroinvertebrate Community Quality: MT MMI= 35.6 O/E= 80%

Site Description

Spur Creek (tributary to the South Fork Moreau)



Figure 49. Spur Creek (AES D005) a tributary to South Fork Moreau River looking upstream



Figure 50. Spur Creek (AES D005) a backed up section behind a culvert

Location: Accessed from County Rd. 3 miles west of Rt. 85 at bridge crossing and proceeded upstream ~50m to the first pool area away from the culvert effects in the reach.

Nearest Town: Redig, Butte County, SD

Ecoregion: Typical Northern Great Plains Steppe

Aquatic Ecological System Type: D005-Northwestern Great Plains Intermittent Stream

Key Environmental Factors: Hydrology—upstream dams or diversions in the watershed; Grazing—moderate impacts

Rare or Unique Species: Marbled Godwit nesting pair

Rare Features: No rare features documented

Introduced/Exotic Species: None

Overall Ecological Site Condition: Fair

Reach Summary: The 100 m reach consisted of 1 run/pool complex with the lower pool being ~70m long and produced by an earthen uprising near the road culvert and containing the deepest fish holding habitat. This stream reach has sparse aquatic habitat and low species diversity (1 fish species). The first run proceeding upstream was shallow (~25cm), but deep enough to allow seining for fish (Figure 49) and

abundant fathead minnows were captured. All substrate of the pools was silt dominated with some embedded gravel in the run upstream. The surrounding vegetation was dominated by *Scirpus* sp. (rushes) and *Eleocharis palustris*, common spikerush. Aquatic vegetation and overhanging banks provided the most significant stream habitat in this stream reach. Livestock use index (LUI) was moderate with ~12 cow pies counted on a 50 m walk of the left & right banks. Pugging and hummocking was especially noticeable below the lower pool area where the cows have a stream crossing.

Reach Riparian Ranking: BLM= 75% (18 of 24) EPA RBP= 75% (150 of 200)

Reach Riparian Geomorphology: The geomorphology of this stream reach is a Rosgen F-6 with a gentle slope (<1%), moderate sinuosity, a riffle-pool configuration with silt-dominated runs and pools. Pools are slightly incised and averaged ~25 cm in depth, wetted width of the reach averaged 1m. Surrounding bank materials are coarser than the channel bed materials indicating an accumulation of sediments in the reach.

Amphibian Community: 5 adult Northern Leopard Frog (NLF) present.

Fish Community: 1 fish species was seined in the pool, none in the run. Only species was the fathead minnow. Expected fish for this stream type (D005 trending toward E005) have been met.

Fish Community Quality: IBI= 48.08 O/E= 1/1.4 or 71% of the expected reference fish.

Macroinvertebrate Community: This community of intermittent prairie stream invertebrates consists of the Prairie Pool assemblage (#12, Stagliano 2005). The community indicator species are characterized by tolerant, damselfly taxa, *Coenagrion/Enallagma* sp. *Enallagma civile*, *Lestes* and *Ishnura*, the crustaceans (*Hyaella* and *Gammarus*), many genera and species of the water boatman (Corixidae: *Sigara alternata*, *Trichocorixa nais*, and *Corisella*), the snails (*Physella*, *Gyraulus*, and *Stagnicola*), mayflies (*Caenis* and *Callibaetis*), and beetles (*Oreodytes*, *Laccophilus*, *Hydroporus* and *Hygrotus*). As the complexity of the pool habitat decreases the clinger habitat species are lost, such as the damselflies and many of the water boatman taxa. Only 60% of the indicator species were present in this sample for a D005 stream type indicating slight impairment. The Montana MMI ranks the community as slightly impaired as well.

Macroinvertebrate Community Quality: MT MMI= 34.9 O/E= 60% of expected macroinvertebrates

Site Description

Hay Creek (tributary to the South Fork Moreau)



Figure 51. Hay Creek (AES D005) a tributary to South Fork Moreau River looking upstream



Figure 52. Hay Creek (AES D005) aquatic water-plantain (*Alisma triviale*)

Location: Accessed from County Rd. 2 miles west of Rt. 85 at bridge crossing and proceeded upstream ~25m to the first pool designated the bottom of the reach.

Nearest Town: Redig, Butte County, SD

Ecoregion: Typical Northern Great Plains Steppe

Aquatic Ecological System Type: D005-Northwestern Great Plains Intermittent Stream

Key Environmental Factors: Hydrology—upstream dams or diversions in the watershed; Grazing—moderate impacts

Rare or Unique Species: Aquatic water-plantain, *Alisma triviale* (Figure 52).

Rare Features: No rare features documented

Introduced/Exotic Species: None

Overall Ecological Site Condition: Fair

Reach Summary: The 100 m reach consisted of 1 run/pool complex with the lower pool being ~80m long and produced by an earthen uprising near the road culvert. This contained the deepest fish holding habitat. This stream reach has sparse aquatic habitat and low species diversity (1 fish species, low numbers). Only 8 fathead minnows were captured after multiple seine hauls. All substrate of the pools was silt dominated with abundant growth of the water-plantain, *Alisma gramineum* (Figure 52). This was the only site of all site visits that contained this wetland obligate plant. The riparian vegetation was dominated by *Scirpus* sp. (rushes) and *Eleocharis palustris*, common spikerush. Aquatic vegetation and overhanging banks provided the most significant stream habitat in this stream reach. Livestock use index (LUI) was moderate with ~15 cow pies counted on a 50 m walk of the left & right banks. Pugging and

hummocking was especially noticeable below the lower pool area where the cows have a stream crossing.

Reach Riparian Ranking: BLM= 66.7% (16 of 24) EPA RBP= 63% (126 of 200)

Reach Riparian Geomorphology: The geomorphology of this stream reach is a Rosgen F-6 with a gentle slope (<1%), moderate sinuosity, a run-pool configuration with silt-dominated pools. Pools are slightly incised and averaged ~25 cm in depth, wetted width of the reach averaged 4.5 m. Surrounding bank materials are coarser than the channel bed materials indicating an accumulation of sediments in the reach.

Amphibian Community: 15-20 adult Northern Leopard Frogs (NLF) were present. No tadpoles were present in pool.

Fish Community: 1 fish species was seined in the pool, none in the run. Only species was the fathead minnow. Expected fish for this stream type (D005 trending toward E005) have been met.

Fish Community Quality: IBI= 44.77 O/E= 1/1.4 or 71% of the expected reference fish.

Macroinvertebrate Community: This community of intermittent prairie stream invertebrates consists of the Prairie Pool assemblage (#12, Stagliano 2005). The community indicator species are characterized by tolerant, damselfly taxa, *Coenagrion/Enallagma sp.* *Enallagma civile*, *Lestes* and *Ishnura*, the crustaceans (*Hyalella* and *Gammarus*), many genera and species of the water boatman (Corixidae: *Sigara alternata*, *Trichocorixa nais*, and *Corisella*), the snails (*Physella*, *Gyraulus*, and *Stagnicola*), mayflies (*Caenis* and *Callibaetis*), and beetles (*Oreodytes*, *Laccophilus*, *Hydroporus* and *Hygrotus*). As the complexity of the pool habitat decreases the clinger habitat species are lost, such as the damselflies and many of the water boatman taxa. Only 50% of the indicator species were present in this sample for a D005 stream type indicating slight impairment. The Montana MMI ranks the community as slightly impaired as well.

Macroinvertebrate Community Quality: MT MMI= 30.5 O/E= 50

Site Description

Jones Creek (site #1)



Figure 53. Jones Creek #1 (AES D005)
small remaining pool in reach



Figure 54. Jones Creek #1 (AES D005) dead snapping
turtle found on side of Rte. 85 bridge

Location: Accessed from Rt 85 at bridge crossing and proceeded upstream ~25m to the first pool designated the bottom of the reach.

Nearest Town: Buffalo, Harding County, SD

Ecoregion: Typical Northern Great Plains Steppe

Aquatic Ecological System Type: D005-Northwestern Great Plains Intermittent Stream trending toward E005 with a loss of connectivity to downstream fish colonization

Key Environmental Factors: Hydrology—upstream dams or diversions in the watershed; Grazing—moderate impacts

Rare or Unique Species: Snapping turtle was found dead on road near bridge (Figure 54).

Rare Features: No rare features documented

Introduced/Exotic Species: None

Overall Ecological Site Condition: Fair

Reach Summary: The 50 m reach consisted of 1 run/pool complex with the lower pool being ~15m long and produced by an earthen uprising (probably old cattle hummocking) and containing the only fish holding habitat except for an artificially produced bridge pool not in the reach. This stream reach has sparse aquatic habitat and low species diversity (1 fish species). The first run/pool complex proceeding

upstream was barely deep enough to allow seining for fish (Figure 53), but fathead minnows were captured. All substrate of the pools was silt dominated with some embedded gravel in the run upstream. The surrounding vegetation was dominated by *Scirpus* sp. (rushes) and *Eleocharis palustris*, common spikerush. Aquatic vegetation and overhanging banks provided the most significant stream habitat in this stream reach. Livestock use index (LUI) was moderate with ~25 cow pies counted on a 50 m walk of the left & right banks. Pugging and hummocking was especially noticeable below the lower pool area where the cows have a stream crossing.

Reach Riparian Ranking: BLM= 66.7% (16 of 24) EPA RBP= 64% (125 of 200)

Reach Riparian Geomorphology: The geomorphology of this stream reach is a Rosgen F-6 with a gentle slope (<1%), moderate sinuosity, a riffle-pool configuration with silt-dominated runs and pools. Pools are slightly incised and averaged ~25 cm in depth, wetted width of the reach averaged 1m. Surrounding bank materials are coarser than the channel bed materials indicating an accumulation of sediments in the reach.

Amphibian Community: 1 adult Northern Leopard Frog (NLF) present. Undetermined toad, *Bufo* sp., tadpoles also present in pool.

Fish Community: 1 fish species (fathead minnow) was seined in the pool, none in the run. Expected fish for this stream type (D005 trending toward E005) have been met.

Fish Community Quality: IBI= 44.77 O/E= 1/1.4 or 71% of the expected reference fish.

Macroinvertebrate Community: This community of intermittent prairie stream invertebrates consists of the Prairie Pool assemblage (#12, Stagliano 2005). The community indicator species are characterized by tolerant, damselfly taxa, *Coenagrion/Enallagma* sp. *Enallagma civile*, *Lestes* and *Ishnura*, the crustaceans (*Hyaella* and *Gammarus*), many genera and species of the water boatman (Corixidae: *Sigara alternata*, *Trichocorixa nais*, and *Corisella*), the snails (*Physella*, *Gyraulus*, and *Stagnicola*), mayflies (*Caenis* and *Callibaetis*), and beetles (*Oreodytes*, *Laccophilus*, *Hydroporus* and *Hygrotus*). As the complexity of the pool habitat decreases the clinger habitat species are lost, such as the damselflies and many of the water boatman taxa. Over 60% of the indicator species were present in this sample for a D005 stream type indicating slight impairment. The Montana MMI ranks the community as slightly impaired as well.

Macroinvertebrate Community Quality: MT MMI= 35.6 O/E= 61.5

Intermittent Fishless Prairie Stream Ecological Type

Intermittent Fishless Prairie Stream (AES code E005). 1) Pine Spring Creek

Site Description

Pine Spring Creek (tributary to the South Fork Grand)



Figure 55. Pine Spring Creek (AES E005) a Great Plains Fishless Intermittent Stream with moderate landscape integrity and degraded local conditions

Location: Accessed from dirt road south of Rt 20, 1.2 miles east of Jump-Off Divide. Site was located in a state-owned section at the culvert road-crossing then proceeded downstream ~50m to the first bend area.

Nearest Town: Buffalo, Harding County, SD

Ecoregion: Typical Northern Great Plains Steppe

Aquatic Ecological System Type: E005-Northwestern Great Plains Fishless Intermittent Stream

Key Environmental Factors: Hydrology—upstream dams or diversions in the watershed; Grazing—moderate to severe impacts

Rare or Unique Species: No rare features documented

Rare Features: No rare features documented

Introduced/Exotic Species: None

Overall Ecological Site Condition: Poor/Fair

Reach Summary: The 100 m reach consisted of 1 run/pool complex with the run having been recently refilled and the pool (~15m long) containing no fish and the only macroinvertebrates in the reach. This stream reach has sparse aquatic habitat and severely trampled riparian area. All substrate of the run was silt dominated with some embedded gravel in the run upstream. The surrounding vegetation was dominated by *Carex nebrascensis* (a heavy-grazing indicator), *Scirpus* sp. (rushes) and *Eleocharis palustris*, common spikerush. Riparian vegetation and grassy banks were heavily grazed. Livestock use index (LUI) was high ~45 cow pies counted on a 50 m walk of the left & right banks. Pugging and hummocking was especially noticeable at the top of the run where the cows have a stream crossing. This sediment

Reach Habitat Ranking: BLM= 66.7% (16 of 24) EPA RBP= 63% (126 of 200)

Reach Riparian Geomorphology: The geomorphology of this stream reach is a Rosgen F-6 with a gentle slope (~1%), moderate sinuosity, a riffle-pool configuration with silt-dominated runs and pools. Pools are slightly incised and averaged ~25 cm in depth, wetted width of the reach averaged 1m. Surrounding bank materials are coarser than the channel bed materials indicating an accumulation of sediments in the reach.

Amphibian Community: No amphibians reported from this site.

Fish Community: None

Macroinvertebrate Community: This community of intermittent prairie stream invertebrates consists of the Prairie Pool assemblage (#12, Stagliano 2005). The community indicator species are characterized by tolerant, damselfly taxa, *Coenagrion/Enallagma* sp. *Enallagma civile*, *Lestes* and *Ishnura*, the crustaceans (*Hyaella* and *Gammarus*), many genera and species of the water boatman (Corixidae: *Sigara alternata*, *Trichocorixa nais*, and *Corisella*), the snails (*Physella*, *Gyraulus*, and *Stagnicola*), mayflies (*Caenis* and *Callibaetis*), and beetles (*Oreodytes*, *Laccophilus*, *Hydroporus* and *Hygrotus*). As the complexity of the pool habitat decreases the clinger habitat species are lost, such as the damselflies and many of the water boatman taxa. Over 60% of the indicator species were present in this sample for a E005 stream type indicating slight impairment. The Montana MMI ranks the community as slightly impaired as well.

Macroinvertebrate Community Quality: MT MMI= 32.5 O/E= 61%

CONCLUSIONS

Diverse fish and macroinvertebrate communities were identified at many aquatic sites of the Slim Buttes region, but the overall highest integrity sites were in the South Fork Grand River basin. Most stream sites visited in the Grand River basin had higher than average landscape integrity reflected at the local reach-scale with high biological integrity. At this scale conservation work in the South Fork Grand basin seems a logical choice, with excellent restoration potential of the Jones Creek site upstream from South Fork Grand #1. With the exception of North Fork Moreau #2, the Moreau basin sites exhibited less habitat integrity, more disturbance and subsequently lower ranking fish and macroinvertebrate communities. For a Medium-Large Prairie River, the Little Missouri River exhibits high quality fish and macroinvertebrate communities. Diverse communities with high biological integrity are highly correlated with good riparian condition and high habitat quality. Thus, effective riparian zone management in the grazing of cattle will contribute to intact vegetation buffers and less sediment in the aquatic environment. Macroinvertebrate communities ranked fewer sites as moderately impaired, but the effectiveness of macroinvertebrates in assessing prairie streams is still under debate in Montana and has not been addressed in South Dakota yet.

Community results from the habitat, fish and macroinvertebrate surveys combined to rank the following sites from highest biological integrity to lowest within their aquatic ecological classification codes:

Medium Prairie River (AES B005): 1) Little Missouri Montana site, 2) Little Missouri #2, 3) Little Missouri@ Camp Crook, 4) South Fork Moreau #3

Northwestern Great Plains Prairie Stream (AES C005): 1) South Fork Grand #2, 2) South Fork Grand #1, 3) North Fork Moreau #2, 4) Jones Creek #2, 5) Crooked Creek, 6) South Fork Moreau #2, 7) Bull Creek

Intermittent Prairie Stream (AES code D005): 1) North Fork Moreau #1, 2) South Fork Moreau #1, 3) Campbell Creek, 4) Spur Creek, 5) Hay Creek, 6) Jones Creek #1

Intermittent Fishless Prairie Stream (AES code E005): 1) Pine Spring Creek

Northwestern Great Plains Perennial Spring (AES code S005): 1) Picnic Spring

Jones Creek site #2, near the confluence with the S. Fork Grand River, has high ecological potential for recovery if hydrologic restoration occurs.

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**APPENDIX A. RAW FISH DATA AND IBI METRIC CALCULATIONS
COLLECTED FROM SLIM BUTTES SITES. INTRODUCED SPECIES ARE
SHADED.**

Fish Species	NF More #1	N F More #2	S F More #1	S F More #2	S F More #3	Jones Cr #1	Jones Cr #2	S F Grand #1	S F Grand #2	Little MO MT	Little MO #2	Little MO #1	Bull Cr #1	Crooked Cr	Campbell Cr	Spur Creek	Hay Creek
Black Bullhead	0	3	28	178	3	0	9	3	1	119	0	0	5	5	0	0	0
Yellow Bullhead	0	0	0	0	0	0	6	3	0	0	0	0	0	0	0	0	0
Common Carp	0	0	0	0	0	0	0	0	0	3	1	2	0	0	0	0	0
Golden Shiner	0	3	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Green Sunfish	0	1	14	9	15	0	21	3	1	69	0	8	0	1	0	0	0
Northern Pike	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Brassy Minnow	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brook Stickleback	0	0	15	0	0	0	0	0	0	0	0	0	0	75	588	0	0
Channel Catfish	0	1	0	0	3	0	0	1	1	12	15	7	0	0	0	0	0
Flathead Chub	0	33	0	0	6	0	30	91	98	22	5	12	0	0	0	0	0
Fathead Minnow	13	14	316	301	333	24	48	7	8	71	0	363	43	159	2	254	8
Goldeye	0	0	0	0	0	0	0	0	0	1	35	8	0	0	0	0	0
Longnose Dace	0	2	0	0	0	0	15	36	16	5	17	28	0	0	0	0	0
Iowa Darter	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Plains Minnow	0	75	0	0	20	0	18	29	13	1	4	4	0	0	0	0	0
River Carpsucker	0	0	0	0	3	0	0	2	4	53	2	16	0	0	0	0	0
Sauger	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
Sand Shiner	0	80	0	1	237	0	219	161	784	537	13	107	0	0	0	0	0
Shorthead Redhorse	0	0	0	0	0	0	0	0	0	1	2	8	0	0	0	0	0
Stonecat	0	0	0	0	3	0	0	3	5	2	4	4	0	0	0	0	0
White Sucker	0	1	6	0	15	0	0	0	0	16	8	12	0	1	0	0	0
Western Silvery Minnow	0	3	0	0	54	0	0	3	3	0	3	18	0	0	0	0	0
Total # Species	2	11	7	5	11	1	8	12	11	14	14	14	2	5	2	1	1
Native Species	2	8	4	3	9	1	5	9	9	11	12	12	1	3	2	1	1
Native Families	1	3	4	3	3	1	1	5	5	5	5	4	1	3	2	1	1
Total Individuals	17	216	386	491	692	24	366	342	934	912	112	597	48	241	590	254	8
# Minnow Species Thrive	2	5	1	2	5	1	4	5	5	4	4	5	1	1	1	1	1
% Tolerant individuals	76.5	8.8	94.3	99.4	52.9	100	21.3	3.8	1.1	30.5	8.0	64.5	100	68.9	0.3	100	100
# Sucker + Catfish Spp	0	4	2	1	4	0	2	4	4	6	5	5	0	2	0	0	0
% Insectivorous Minnows	0.0	52.3	0.0	0.2	35.1	0.0	68.0	73.7	94.4	61.4	47.3	21.3	0.0	0.0	0.0	0.0	0.0
# Benthic Invertivore Spp.	0	3	2	1	4	0	3	5	5	6	4	5	0	1	0	0	0
% Lithophilic Spawners	0.0	38.0	0.0	0.2	35.1	0.0	63.9	59.1	86.6	65.7	67.0	28.6	0.0	0.0	0.0	0.0	0.0
% Parental Care	76.5	8.3	93.0	97.6	49.0	100	17.2	4.1	1.1	22.1	13.4	62.0	100	99.2	100	100	100
% Native to South Dakota	100	72.7	57.1	60.0	81.8	100	62.5	75.0	81.8	78.6	85.7	85.7	50.0	60.0	100	100	100
# Long Lived Species	2	7	4	3	6	1	5	9	8	10	10	8	1	3	2	1	1

**APPENDIX B. MACROINVERTEBRATE TAXA AND ABUNDANCE FOR THE
MEDIUM PRAIRIE RIVER SITES**

Taxa	Little Mo MT	Little Mo #1	Little Mo #2	SF Moreau #3
Agabus	0	0	0	2
Acarina	0	0	2	0
Ablabesmyia	4	0	13	19
Ambrysus	1	4	1	5
Baetis intercalaris	18	81	4	0
Baetis tricaudatus	69	20	12	0
Caenis sp.	0	0	0	10
Caenis latipennis	4	8	77	26
Callibaetis	0	0	0	1
Centroptilum	4	0	1	0
Cercobrachys	1	0	1	0
Ceratopogoninae	0	0	17	4
Cheumatopsyche	43	147	3	5
Chironomus	1	0	5	0
Cladotanytarsus	0	0	2	2
Corixidae	4	2	44	46
Cricotopus	2	1	0	6
Cricotopus bicinctus	1	2	2	16
Cricotopus (Isocladius)	0	0	1	0
Cryptochironomus	0	0	6	0
Cryptotendipes	0	0	0	1
Dicranota	2	1	0	0
Dicrotendipes	5	1	54	0
Dubiraphia	3	2	17	115
Dytiscidae	0	0	0	2
Enallagma	0	0	3	6
Ephoron	1	0	0	0
Fallceon quilleri	4	2	2	10
Gomphidae	4	0	0	0
Gomphus externus	1	0	0	0
Hyalella	2	0	2	10
Hydropsyche	12	46	0	4
Hydropsychidae	2	7	0	0
Hydroptila	2	0	3	1
Hygrobates	3	0	0	13
Isonychia	1	11	0	0
Ithytrichia	11	14	0	8
Labrundinia	0	0	0	15
Larsia	0	0	3	0
Leptophlebiidae	1	0	0	0
Leucrocuta	44	12	3	0
Mayatrichia	1	0	0	0
Microcyloopus	1	2	2	0
Nanocladius	4	0	0	0
Nectopsyche	2	0	0	0
Nematoda	5	7	0	0

Taxa	Little Mo MT	Little Mo #1	Little Mo #2	SF Moreau #3
Neotrichia	7	2	0	0
Ochthebius	0	0	0	1
Oligochaeta	33	38	0	1
Ophiogomphus severus	1	4	0	0
Ostracoda	0	0	1	0
Palmarcorixa	0	0	18	0
Paracloeodes minutus	4	0	0	0
Paratanytarsus	1	2	0	16
Parakiefferiella	0	0	0	113
Physella	0	0	3	5
Polypedilum	22	31	2	0
Procladius	0	0	5	0
Pseudocloeon	1	0	0	0
Psectrocladius	0	0	0	4
Pseudochironomus	0	0	0	24
Rheotanytarsus	0	0	0	3
Saetheria tylus	23	2	0	0
Sialis	2	1	1	0
Sigara	0	0	4	0
Simulium	3	13	0	13
Sperchon	6	3	0	1
Stenelmis	2	4	3	0
Stenonema	12	3	0	0
Tanytarsus	3	0	7	0
Thienemanniella	8	3	0	0
Thienemannimyia	2	0	7	0
Tricorythodes	5	2	1	0
Tropisternus	0	0	0	1
Total Taxa Richness	50	32	36	34

**APPENDIX C. SIGNIFICANT INDICATOR SPECIES ($p < 0.05$) OF THE
MACROINVERTEBRATE COMMUNITY GROUPS. OIV=OBSERVED
INDICATOR VALUE OF THAT TAXON**

Taxon	Group	OIV	Average	Std Dev	p-value
Transitional Prairie River					
Cricotopus sp.	3	40.6	11.8	3.83	0.001
Rheotanytarsus	3	31.7	8.8	3.6	0.002
Tricorythodes	3	26.5	10	3.47	0.003
Cricotopus trifascia grp	3	31.5	7.9	3.79	0.003
Naididae	3	24.2	7.3	3.61	0.004
Oecetis avara grp	3	19	5.5	3.53	0.009
Monodiamesa sp.	3	14.1	4.8	3.04	0.015
Camelobatidius	3	15.5	5.3	3.16	0.015
Stenelmis sp.	3	21.4	7.8	4.3	0.016
Leucotrichia pictipes	3	13.9	4.6	2.91	0.017
Neotrichia sp.	3	13.9	5	3.19	0.022
Psychomyia sp.	3	11.2	4.7	2.93	0.039
Fallceon quilleri	3	13.7	6.8	3.34	0.041
Acentrella insignificans	3	15	7.1	3.62	0.043
Ephoron album	3	13.7	6.1	3.61	0.044
Travarella albertana	3	10.1	5.3	3.08	0.051
Prairie Stream Assemblage					
Caenis latipennis	9	66.5	7.7	3.37	0.001
Ceratopogon sp.	9	37.1	8.5	3.94	0.001
Coenagrion	9	52.3	6.3	3.37	0.001
Labrundinia	9	26.2	3.9	2.51	0.001
Dubiraphia	9	21.1	3.8	2.48	0.002
Enallagma civile	9	17.6	3.8	2.35	0.003
Physella	9	27.7	11.1	3.52	0.005
Enallagma sp.	9	16.6	3.9	2.42	0.005
Sigara alternata	9	16.4	4.5	3.16	0.011
Psectrocladius	9	13.5	4.6	2.95	0.024
Sigara grosslineata	9	11.8	4.2	2.89	0.029
Trichocorixa	9	9.1	3.9	2.36	0.046
Large Prairie River Assemblage					
Cheumatopsyche	11	54.7	9.9	3.18	0.001
Chironomidae	11	23.3	5.9	3.37	0.003
Neochoroterpes oklahoma	11	16.6	4.2	2.7	0.005
Choroterpes	11	23.5	7.3	4.14	0.009
Ambrysus mormom	11	19.9	7.1	3.72	0.011
Hemerodromia	11	18.4	6.1	3.69	0.015
Microcylloepus	11	13.6	5.5	3.08	0.026
Hydropsyche morosa grp	11	12.2	5.8	3.16	0.044
Hydrochus	11	8.8	4.1	2.77	0.048
Prairie Stream Pool Assemblage					
Hyaella	12	62.2	9.5	3.24	0.001
Coenagrion/Enallagma	12	32.7	4.8	2.67	0.001

Taxon	Group	OIV	Average	Std Dev	p-value
Prairie Stream Pool Assemblage					
Gammarus sp.	12	27.8	7	3.79	0.004
Callibaetis	12	30.4	7.4	4.02	0.005
Glyptotendipes	12	18.7	6	3.37	0.005
Trichocorixa nais	12	15	3.9	2.58	0.005
Gyraulus	12	22.4	7.2	3.79	0.008
Endochironomus	12	18.5	5.8	3.7	0.008
Haliphus	12	17	5.7	3.03	0.009
Paratanytarsus sp.	12	20.2	5.6	3.54	0.011
Mystacides sp.	12	13.2	4.2	2.76	0.015
Molanna	12	10	4	2.64	0.033
Hygrotus	12	9.8	4.1	2.72	0.044
Caenis youngi	12	9.1	4.1	2.63	0.049
Erpobdella	12	11.1	5.3	3.07	0.05
Corisella	12	9.4	4.2	2.87	0.05
Stagnicola	12	12	5.4	3.6	0.051
Collector-Filterer Assemblage					
Simulium sp.	37	67.6	13.2	3.78	0.001
Isonychia sp.	37	21.4	6.6	3.87	0.01
Stylurus sp.	37	10.7	4	2.6	0.02
Eukiefferella claripennis grp	37	12.1	4.7	3.07	0.029
Pseudocloeon	37	9.4	4.4	2.85	0.049
Hydropsyche confusa	37	10.8	5	3.32	0.05
Medium River Side-Channel					
Corixidae	40	71.1	8.4	3.26	0.001
Cryptotendipes	40	21.7	6.2	3.45	0.004
Placobdella	40	14.3	4.3	2.61	0.004
Tubifex	40	16.4	4.3	2.68	0.007
Procladius	40	20.4	6.9	3.31	0.008
Cryptochironomus	40	15.7	6.7	2.46	0.009
Stempelinella	40	18.8	5.5	3.36	0.013
Tanytus	40	14.5	6.2	3.54	0.041
Centroptilum	40	11	4.8	2.84	0.047
Gomphus sp.	40	9.4	4.2	2.85	0.052
Palmarcorixa gilletti	40	11.6	5.4	3.44	0.053
Probezzia	40	11.1	5.5	3.61	0.053

**APPENDIX D. MACROINVERTEBRATE COMMUNITY DESCRIPTIONS
(SPA-SPECIES ASSEMBLAGE) (FROM STAGLIANO 2005).**

Group 3 – Transitional Prairie River Assemblage. This widespread community type occurred in the Little Missouri River (4th –7th order medium to large warmwater rivers). The habitat quality of these systems was rated medium to high with grazing and agriculture dominant land uses in these systems, so sediment could be a problem. Genera associated with this group are moderately tolerant to sediment and nutrients. Representative indicator taxa: *Camelobatidius*, *Stenelmis*, *Leucotrichia pictipes*, *Tricorythodes*.

Group 9 - Prairie Stream Assemblage. This ubiquitous prairie stream community type is found in all basins and is associated with small to medium (2nd-5th order) prairie streams with the lowest elevation and gradient. Although this group is found in small to large stream systems, it typically occurs in slow current areas with silted, sand /gravel /cobble substrates, often with aquatic vegetation. The riffle areas of these may have clean mixed cobble substrates similar to Group 3 habitats, but with less flow. Prairie streams examples: S F Grand River, Jones Creek #2. Indicator taxa are typical of low-gradient streams and are tolerant to disturbance: *Caenis latipennis*, *Ceratopogon*, *Coenagrion*, *Enallagma civile*, *Physella*, *Dubiraphia*.

Group 11 – Large Prairie River Assemblage. This group occurred in downstream confluence areas and is associated with warm-water medium and large rivers (4th-7th order) of lower elevation and moderate gradient. Although this group is a large stream system community similar to Group 1, it is found in areas with more agricultural land use and sediment deposition than Group 1. Indicator taxa are relatively tolerant to disturbance and typical of low gradient streams with stable substrates and a slow-moderate current velocity. Example rivers: Frenchman Creek, Missouri River, and Powder Rivers. Indicator taxa consist of genera from many insect orders tolerant of sedimentation and moderate pollution: *Cheumatopsyche*, *Neochoroterpes oklahoma*, *Choroterpes*, *Ambrysus mormon*, *Hemerodromia*, *Microcyloepus*, *Hydropsyche morosa* grp.

Group 12 – Prairie Pool Assemblage. This group is associated with slow-moving small to medium warm-water prairie streams (2nd -5th order) of low-mid elevation, low gradient, typically with heavy aquatic vegetation and low current or stagnant pool areas. Group 12 is a highly tolerant group of invertebrates that can withstand low oxygen, high temperatures and siltation. Even though this group can be found in large warmwater prairie systems, similar to Groups 9 and 11, it is found in areas with less current and higher sediment influences. Stream examples: Hanging Woman, Sarpy, Coffee, O’Fallon Creek, Thompson, Otter Creeks. Indicator taxa: *Hyaella*, *Coenagrion/Enallagma*, *Gammarus* sp., *Callibaetis*, *Glyptotendipes*, *Trichocorixa nais*, *Gyraulus*, *Erpobdella*, *Corisella*, *Stagnicola*

Group 37 – Filtering-Collector Assemblage. This moderately tolerant macroinvertebrate group is associated with warm-water medium and large rivers (4th-6th order) of low elevation (2000-3500 ft), high nutrient/turbidity and slow-moderate current velocity with stable shifting substrates. This community occurs in sand/gravel substrates of large rivers (A003, B005) or smaller (C005) degraded streams with sediment and nutrient problems. Two indicator taxa, *Simulium* and *Hydropsyche confusa*, can quickly colonize newly exposed substrates, so shifting sediments will not disturb this community. Most indicator taxa are filterer-collectors or predators and can tolerate streams with higher sediment influences than most other large stream/ river communities. Stream and river examples: Little Missouri River, SF Grand, NF Moreau. Indicator taxa: *Simulium*, *Isonychia*, *Stylurus*, *Eukiefferella claripennis* grp., *Pseudocloeon*, *Hydropsyche confusa*

Group 40- Medium River Side-Channel Community. This community group consisting of moderately tolerant macroinvertebrates is associated with medium to large (3rd-6th order) warmwater rivers, medium turbidity, moderate gradients, low elevation (2500-4000 ft.) gravel/cobble dominated with silted side channels. Slim Butte River examples: Little Missouri, SF Moreau and Jones Creek #2. Indicator taxa include: Corixidae, *Cryptotendipes*, *Placobdella*, *Tubifex*, *Procladius*, *Cryptochironomus*, *Stempelinella*

**APPENDIX E. FISH COMMUNITY DESCRIPTIONS (SPA-SPECIES
ASSEMBLAGE) (FROM STAGLIANO 2005).**

Group SPA #1-Large Warmwater River Assemblage. This community was dominated by larger, warmwater river fishes, including many of our natives, such as the sauger (*Stizostedium canadense*), big (*Ictiobus cyprinellus*) and smallmouth buffalo (*Ictiobus bubalus*) and the emerald shiner (*Notropis atherinoides*), but also included fish species introduced to the Missouri and Yellowstone drainages: smallmouth bass (*Micropterus dolomieu*), perch (*Perca flavescens*), walleye (*Stizostedium vitreum*) and northern pike (*Esox lucius*). Warmwater generalists such as sunfish, bass and golden shiners are also closely associated with this group in the Yellowstone drainages. As a general rule this assemblage is found in larger, low gradient, glide-pool main branch streams (4th -6th order) with an average summer temperature of 20-25°C. The 2 native ictalurid species, the stonecat (*Noturus flavus*) and the channel catfish (*Ictalurus punctatus*), also cluster in this assemblage. This community can be found over a wide range of low-elevation landscapes within all three ecoregions of the study area.

Group SPA #2- Medium Warmwater River Assemblage. Most of the medium to large warmwater river cyprinid species occur in this species assemblage (flathead chub, *Platygobio gracilis*; sand shiner, *Notropis stramineus*; plains minnow, *Hybognathus placitus*; western silvery minnow, *Hybognathus argyritus*), as well as the shorthead redhorse (*Moxostoma macrolepidotum*), river carpsucker (*Carpodes carpio*), the exotic carp (*Cyprinus carpio*), the introduced green sunfish (*Lepomis cyanellus*) and black bullhead (*Ameiurus melas*). This species assemblage occurs in most of the Medium Prairie Rivers of Montana. The channel catfish & stonecat could co-occur within SPA 1 or 2 if proper habitat requirements are met, such as deep, side channel pools and large structures for hiding (large cobbles and woody debris).

Group SPA #18-Brook Stickleback Assemblage. Includes the brook stickleback (*Culaea inconstans*), brassy minnow (*Hybognathus hankinsoni*) and Iowa Darter (*Etheostoma exile*). This species assemblage is found most commonly associated with small Northwestern Great Plains prairie streams (AES C006 and D006) with relatively clear water, large pools and vegetative cover.

Group SPA # 20-Core Prairie Stream Assemblage. Includes an assemblage of small native prairie fish that form the core community for perennial prairie streams (AES code C005 in the Northwestern Great Plains and C006 in the Northern Glaciated ecoregions. Included in this assemblage are the longnose dace (*Rhinichthys cataractae*), lake chub (*Couesius plumbeus*), fathead minnow (*Pimephales notatus*) and the white sucker (*Catostomus commersoni*). The lake chub and fathead minnow (*Pimephales notatus*) are species that occur in similar habitats of intermittent prairie stream systems D005 and D006, although we found no lake chubs in any of the Slim Butte streams. As the small prairie streams dominated by this core species assemblage proceed downstream and increase stream order and linkages, they develop into the Medium Prairie River Community including the plains and western silvery minnows (plains minnow is more tolerant of current, while the western silvery will be found in the protected silted side channels out of the current), and the sand shiner (in slower pools of B005 or larger streams with gravelly/sandy bottoms), and the exotic carp and introduced black bullhead.